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The Teaching of Radiology[1]

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THE OCCASION of the present gathering, the first of the Leo Rigler Lectures, may well be considered as an important milestone marking a new and forward-looking step in the progress of radiology as a full-fledged specialty. Certainly no thoughts here expressed, no mere vocal statements made by any of us, will materially alter the present or future stature of that vigorously growing branch of medical endeavor. It is, however, important that the University of Minnesota has established an annual lectureship in the name of an outstandingly energetic and stimulating teacher of radiology, even now at the height of his effectiveness. This act, conceived and accomplished by his former students, his colleagues, other friends, and the splendid institution of which he is a part, must be looked upon as a rare compliment to Leo Rigler's accomplishments, as well as a formal acknowledgment of the far-reaching importance and future promise of the branch of medicine which he has chosen. This public expression of encouragement and confidence will not pass unheeded—will lead to greater and more sustained progress in the advancement of radiology.

In years to come, when succeeding lecturers take up the theme which will run through the many chapters yet to be written for this series, rich tribute will be paid to the fine personal qualities and the sound professional accomplishments of the man whose impact upon his associates locally and throughout the medical world stimulated the creation of the Rigler lectureship. Upon this, the founders' day gathering, rather let us look into the future of the medical specialty which has attracted to its service a man of Dr. Rigler's stamp, to determine if we can whether his devotion to that specialty is likely to be justified—whether succeeding waves of medical students will be well advised to seek thorough preparation in the radiological approach to the problems of medical practice.

Forty-nine years to the month, or at least to the season, after Wilhelm Conrad Röntgen's momentous description of a new form of rays capable of penetrating many substances opaque to visible light, this enormously important contribution to present-day medical practice requires no exposition before physicians or patients. Seldom has any single addition to the sum of human knowledge been exploited so rapidly, so extensively, or so usefully. In our time we are privileged to observe that the rate of acceleration at which medical radiology is expanding continues to in-

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crease. There is as yet no indication that the long-range benefits to be derived from Röntgen's truly great discovery have been fully realized.

The extreme speed with which every innovation involving the diagnostic or therapeutic utilization of radiological principles is absorbed into daily medical practice renders further advance progressively more difficult. The rising load of clinical duties constantly threatens to submerge teaching activities and research by the very persons who are most able and anxious to indulge in such pursuits. Practical and academic duties are so intimately interwoven in the radiological divisions of all American medical schools that neither can be emphasized without detriment to the other. Since the local markets for routine clinical output are so genuinely eager, teaching and research activities are more often than not conducted as a side line of lesser importance.

At the University of Michigan, where actual conditions are well known to me by first-hand contact, utilization of the clinical services offered by the Department of Roentgenology has increased steadily over a period of fourteen years until annual patient visits in this division exceed total patient registrations by a considerable margin—56,000 versus 30,000. Apart from the photofluorographic chest survey of all patients at the registration counter of the hospital, eight of every ten persons who apply for medical advice or care find themselves referred for some form of radiological service within three months after registering at the clinic. If nothing beyond routine clinical duties were required of the staff in radiology, the aggregate load of such work would amply justify its existence. The maintenance and operation of the specialized apparatus required, administration of the affairs of the professional and non-professional staff members, the handling of patients, and the preparation of suitable reports to be filed in clinical case histories constitute a sizable effort. In addition, the department carries on a considerable variety of teaching efforts at undergraduate, graduate, and postgraduate levels. As best it can, the staff has indulged in clinical investigations within its scope. Regardless of all theoretical concepts concerning the relative importance of these various activities, it is the plain truth that the accomplishments of the department are measured primarily by the efficiency with which routine clinical service is provided, not by the quality of instruction offered nor by the quantity or excellence of research. This state of affairs in one American educational institution will serve as a fair sample of the situation at large.

In some of the outstanding medical schools of the country, the high market values attainable by radiologists of ability have been responsible for the penetration of the profit motive into academic radiology. It is variously argued that this is a necessary evil—necessary if the best talent is to be lured into the teaching field—or that it constitutes a genuine virtue—the virtue of preserving the truest possible replica of the conditions which actually prevail in radiological practice throughout the specialty at large. Whatever the justification offered, it can scarcely be true that further emphasis upon the daily application of already acquired knowledge is either necessary or desirable from the point of view of universities, whose avowed reasons for existence are to teach students and to foster investigation.

In many institutions, the University of Minnesota being one, radiology, when added to the medical curriculum and to the clinical services of the teaching hospital, was grafted onto one of the existing clinical divisions, usually internal medicine or surgery. The results of this practice have been multilateral. On the one hand, medical school radiologists serving on this basis have been spared much in the way of nonproductive administrative duties, while on the other hand, the fruits to be derived from administrative endeavors, had they been directed toward the specific welfare of radiology, have been denied. Radiology has reached a stage in the course of its

development which easily justifies department autonomy. Its interests, clinical, educational, and in the matter of scholarly achievement, are sufficiently distinctive and extensive to warrant a full voice in medical school affairs and independent choice of policy. Since radiological procedures always have been able to support themselves financially, radiology does not need budgetary support from a parent department. Both the University of Michigan and the University of Minnesota now recognize radiology as a full-fledged medical school department and the same is true for several other institutions. Wherever this plan has been adopted, the teaching of radiology has flourished.

Whether radiology is accorded departmental status or is relegated to a position of secondary importance in the organization of medical schools, the rapidly expanding application of radiological principles in the practice of medicine must impress us with the desirability of expanding our teaching in this field. It is highly desirable that any move in this direction shall be designed to benefit *all* students, not merely those who have expressed a desire to devote themselves to this branch of medicine as specialists. Unlike specialists in most other clinical branches, radiologists utilize skills and instruments which have an almost universal application. Today it is quite impossible for any physician to disregard the radiological considerations which figure so importantly in the diagnosis or treatment of almost every disease. The undergraduate study of medicine is rendered more effective and more attractive by an understanding of the principles upon which the specialty of radiology is based. One cannot teach the x-ray signs of disease, the results to be expected of radiation therapy, as a subject totally apart from other diagnostic and therapeutic considerations. To be appreciated properly, the benefits to be derived from radiological procedures must be interwoven inextricably in the student's mind with his concept of the basic sciences and the preclinical subjects, as well as his understanding of disease as it is encountered in the practice of medicine. At Michigan it is our aim to equip every physician who graduates with a sufficient understanding of the possibilities, the limitations, and the shortcomings of radiology to permit him to evaluate the radiological services which will be rendered to his patients in future years—to teach him to use such services to the fullest advantage. While we do presume to train a limited number of graduate students who desire to devote their full energies to our specialty, we consider that the impressions which we leave upon the entire undergraduate student body represent our most important contribution to the University, routine clinical performance not excluded.

There is a place for radiology in the general plan of undergraduate medical education, a place for the presentation of the subject as an academic entity rather than a highly valued, though strictly utilitarian, handmaiden to the various clinical divisions. An understanding of the basic principles upon which the useful medical applications of radiant energy depend is fully as important to the intelligent practice of medicine as are the time-honored drills in the technics of bacteriology, biochemistry, and pathology. As medicine is practised today, the sum total of the evidences of disease made available through the employment of x-rays is certainly no less voluminous or helpful than the information which is derived from the application of those "classical" sciences. Few indeed are the physicians who find it necessary or desirable to carry out in person the exacting laboratory methods of Kjeldahl distillation, the recovery in pure culture of pathogenic organisms, or the sectioning, mounting, and histologic study of tissues, in order to serve their patients. It is argued with entire propriety, however, that as students physicians must have familiarized themselves with the methods and the scope of content as well as the philosophy of the various subjects which, moulded into an amazingly intricate whole, constitute the science of medicine. With the passage of busy years, replete with

memorable highlights of diagnostic and therapeutic triumphs, radiology has grown from the lowly stature of an interesting novelty to the proportions of mature adulthood in the scheme of clinical medicine. About its activities there has developed a philosophy which is entirely distinctive and one which it is important for physicians to understand. It is high time that the teaching of radiology should adequately reflect the far-reaching importance of the subject.

In particular, the subject of radiation therapy deserves thoughtful and comprehensive treatment in the course of undergraduate medical education if its rational employment is to be expected. The past record of radiation therapy is far too checkered, and its present status, in the minds of radiologists and physicians in general, is too vague to hope that successive crops of new graduates will enter upon their lifetime careers possessed of sufficient respect for its potentialities unless teaching methods include more than casual coverage of this most difficult and elusive subject.

Differences in curriculum arrangement and content are too wide to permit the development of a detailed plan of undergraduate teaching in radiology which would serve equally well in all medical schools. Furthermore, the distinctive features which depend upon the particular abilities and interests embodied in various faculties will, and properly should, color the instruction offered in this as in other branches. It is possible, however, to outline the principal aims which should govern the building of a teaching plan for radiology and to suggest to some degree a time table for the application of such a plan. Approaching the matter with the responsibility of the medical school to its students and to the public uppermost in mind, it can be said that student instruction in radiology should consist of:

A. A study of the fundamental physical phenomena related to the production and the medical utilization of roentgen and radium rays.

B. The presentation of the roentgenographic and fluoroscopic appearances of anatomical structures and physiological functions.

C. The demonstration of the radiological characteristics of disease.

D. A theoretical and practical consideration of the biological effects of radiant energy.

E. Training in the application of the foregoing fundamentals in the daily practice of medicine.

So long as academic departments of radiology continue to be disproportionately burdened with clinical routine, the bulk of student teaching will fall in the last category, while physical considerations and the other topics listed will receive indifferent coverage in formal lectures. The time-honored lecture system of medical teaching has for some time been under the scorching fire of progressive educators. Informal quiz-conferences which open wide the door to spontaneous discussion are far more effective. Several serious efforts to mend the situation have been made by individual schools, but to date there has appeared no encouraging sign to indicate a determined effort by medical educators to provide for the most desirable radiological teaching that is possible.

Students, freshly turned out from the laboratories of physics and chemistry and heading toward the biological sciences which are offered in the first two years of medicine, are well conditioned for an introduction to the fundamental principles upon which clinical radiology is based. This is the logical moment to arouse interest in such matters. From the physical considerations of the production of radiation and the chemical aspects of photography, transition to the utilization of radiological methods in the study of anatomy and pathology is logical and easy. The active interest of students at this level is easily captured.

It is here that changes in tissue density dependent upon gross and microscopic alterations in structure can be discussed without causing the student to feel that he is looking away from clinical practice. During the study of physical diagnosis, radiological methods, if available to the student,

can be employed by him to great advantage, convincing him incidentally of their real utility as a fact-finding agency. It is important for him to realize that roentgen diagnosis and physical diagnosis are one and the same. Prepared in this fashion students embark upon the complicated business of applying their fund of acquired medical knowledge to the solution of individual problems of diagnosis and medical management, ready to use x-ray evidence and radiation therapy intelligently and to their great advantage.

The proposal that radiology be presented as an academic subject throughout the four years of the undergraduate curriculum, long the theme of discussion at gatherings of radiologists, has provoked little response from the governing bodies of medical schools. No program designed to present the subject in this comprehensive fashion can be expected to succeed unless the staff in radiology includes members prepared to present each phase of the subject and, what is fully as important, unless they are provided with suitable facilities and insured sufficient relief from clinical responsibilities to perform as intended. Whereas it is essential that students in the clinical years shall have opportunity to observe and take part in the purely clinical activities of a busy, well rounded radiological laboratory, it is equally important that the radiological division shall have a student laboratory, a film library, and teaching facilities available within the preclinical divisions. It is highly desirable for all members of the radiology staff to maintain proficiency in the purely clinical field when particular teaching duties will permit. It should not be true that fundamental teaching is done at the sacrifice of the division's clinical proficiency. Translated into other terms, this means a larger, more versatile staff for radiology and larger, more well rounded physical facilities. All of this every medical school x-ray division can afford to provide out of its clinical earnings if permitted by the administration to do so. The only restraining influence at the moment is the lack of initiative on the part of medical schools to offer the best possible instruction in this field. It is the duty of radiologists attached to medical schools to provide that initiative as well as to strive toward the complete fulfillment of their responsibilities as teachers.

If I were to be asked by the Dean of our school to present a bill of particulars which in my estimation would cover the changes necessary to present radiology to our students in its proper perspective, my request would read as follows:

(1) Exchange of the 64 hours of instruction now offered in the third year for eight four-hour laboratory periods in the first year, eight demonstration hours in the second year, eight lectures and 32 group conference hours in the third year, and eight group conference hours in the fourth year. This would constitute an overall increase of 24 hours, bringing the total to 88.

(2) Addition of one broadly trained clinical radiologist with proved ability as a teacher of radiation physics.

(3) Floor space of about 3,000 sq. ft. well apart from the clinical laboratory and readily accessible to the quarters of the preclinical divisions, for the establishment of a student laboratory, a museum of x-ray equipment, a classroom to accommodate one-fourth of the freshmen, laboratories for animal experiments, equipped with diagnostic and therapeutic apparatus for use of the radiology staff, and a well equipped machine shop with two full-time toolmakers to maintain equipment in the clinical quarters and to build apparatus for demonstration and research purposes.

The spreading of teaching time to cover four student classes rather than one, with the incidental addition of twenty-four hours, would present a real problem to the curriculum committee and would require the relinquishment of hours by some other division, always a ticklish matter.

The enlargement of the permanent staff by one assistant professor would add one salary of four to six thousand dollars. This would provide a measure of academic leisure to all members of the radiology staff to be enjoyed in rotation, and incidentally the versatility and freshness of clinical service would be augmented.

The development of separate quarters for the non-clinical activities to be started would represent an initial expenditure of $40,000 to $50,000 for equipment and building renovations and an annual addition to the budget of $10,000 to $15,000 for machinists' salaries and materials.

If, to continue with this hypothetical situation, the Dean were to inquire where the necessary funds were to be found, my answer would be prompt and emphatic. I would recommend an initial loan of $50,000 by the University for capital outlay, secured by the allocation of 50 per cent of the net proceeds of clinical activities of the department for a period of five years. Thereafter the added operating expense would be covered by 25 per cent of current clinical proceeds earmarked for that purpose. It is my firm belief that this proposal is sound financially as well as academically. Able physicians, broadly trained in radiology and imbued with the ambition to follow a career of academic medicine, would find the fullest outlet for their energies in such surroundings. Medical students at Michigan would be exposed in the broadest fashion to the possibilities offered by radiology. The department's clinical performance would be enhanced by new advances in radiological knowledge effected by its own staff and students. The entire venture would be self-sustaining.

It is not to be expected that sweeping changes such as those here suggested will come about spontaneously, nor that they will be forced upon teaching departments of radiology without insistent demands from within. So long as students, faculties at large, and the alumni of medical schools are content to have radiology exist primarily as a hospital service division, and until radiologists in teaching positions are aroused and committed to a program which offers full-scale performance, it is idle to presume that any such development will come to pass.

It goes without saying that the purely clinical aspects of radiological teaching should include the training of a few well chosen candidates for specialization. This can be done under existing conditions; it is being accomplished creditably at the present time. Radiology at many institutions now offers postgraduate or continuation study of acceptable quality, and the value of inter-departmental clinical conferences is thoroughly appreciated by all participating divisions. Primary emphasis upon the undergraduate responsibilities of radiology in no degree threatens the scope or the quality of these activities; it insures rather their continuation at a decidedly higher level.

With the courteous indulgence of a most sympathetic jury I have had my day in court. I have been permitted to air my own personal ambitions for academic radiology and have outlined a dream regarding a point of departure for bigger and better things in our specialty. This evening's dissertation must be considered in the light of a preliminary hearing to which other Rigler lecturers may be expected to add pleas variously modifying the views here offered by one individual. I am extremely grateful to have been accorded this opportunity to christen the Rigler lectures, much as a new ship is committed to its element, with the fervent wish for smooth sailing and a proud record of achievement in the lives of men.

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The Clinical Significance of Deformity of the Cecum in Amebiasis[1]

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AMEBIASIS is defined as the presence of the *Endamoeba histolytica* in the wall of the large intestine or in other tissues. The clinical diagnosis of the disease depends primarily upon the demonstration of the organism in one or another of its forms in the stools of the patient. Vallarino (1925) showed that in some cases lesions were produced in the colon which were demonstrable by roentgen methods. Weber (1933) and Bell (1936) demonstrated deformity and shrinking of the cecum in a number of cases of amebiasis. The purpose of this paper is to present a series of cases which confirms the observations of Weber and of Bell and which emphasizes the practical value of recognition of the cecal deformity. No attempt will be made to discuss details of symptoms, treatment, or other aspects of the disease.

INCIDENCE OF AMEBIASIS

Competent observers believe that amebiasis is not uncommon among the people of the United States. Craig (1940) stated: "In this country numerous surveys have shown that the incidence of the infection varies from one per cent in some localities to as high as 30 to 40 per cent in others. The incidence in 69,000 individuals surveyed in the United States and collected by the writer has been a little over 10 per cent. It may be conservatively stated that from 5 to 10 per cent of the people of this country harbor the parasite and that the percentage is higher in the south than in the north." Craig and Faust (1943) estimated that 13,000,000 people in this country are infected.

In a series of 202 necropsies in accident cases in New Orleans, Faust found *E. histolyticae* present in the fecal content of the large intestine in 13 (6.4 per cent) and demonstrated amebic lesions in the mucosa in 7.

SYMPTOMS

The *E. histolytica* in the large intestine may or may not cause symptoms. Amebic dysentery, *i.e.*, amebiasis with severe diarrhea, occurs in only a small number of patients with amebiasis. D'Antoni (1942) stated that in 1939 amebic dysentery was reported in 2,981 individuals in 33 states with a total population of 107,355,000. "Although these reports probably do not represent the actual number of cases, it is significant that only a small proportion of patients infected with E. histolytica showed dysentery." D'Antoni believed the non-dysentery cases to be the major problem.

The commonest symptoms in the non-dysentery cases (Craig and Faust) are constipation, attacks of slight diarrhea, underweight, colicky pains in the lower abdomen or right lower quadrant, and pains in the head, back, and extremities. The symptoms (D'Antoni) may simulate cholecystitis, peptic ulcer, or appendicitis. The presenting symptom in one of our patients was persistent fever of several months' duration. Fever with leukocytosis was associated with other symptoms in several of our cases. The patients without symptoms are called carriers.

PATHOLOGY

The primary lesion of amebiasis is an ulcer which involves the mucosa, which may extend into the submucosa but which does not penetrate the tunica muscularis James (1928) described two types of ulcer,

[1] From the Departments of Radiology of the Presbyterian Hospital and of the College of Physicians and Surgeons, Columbia University, New York City. Read before the Joint Meeting of the American Roentgen Ray Society and the Radiological Society of North America, Chicago, Ill., Sept. 24–29, 1944.

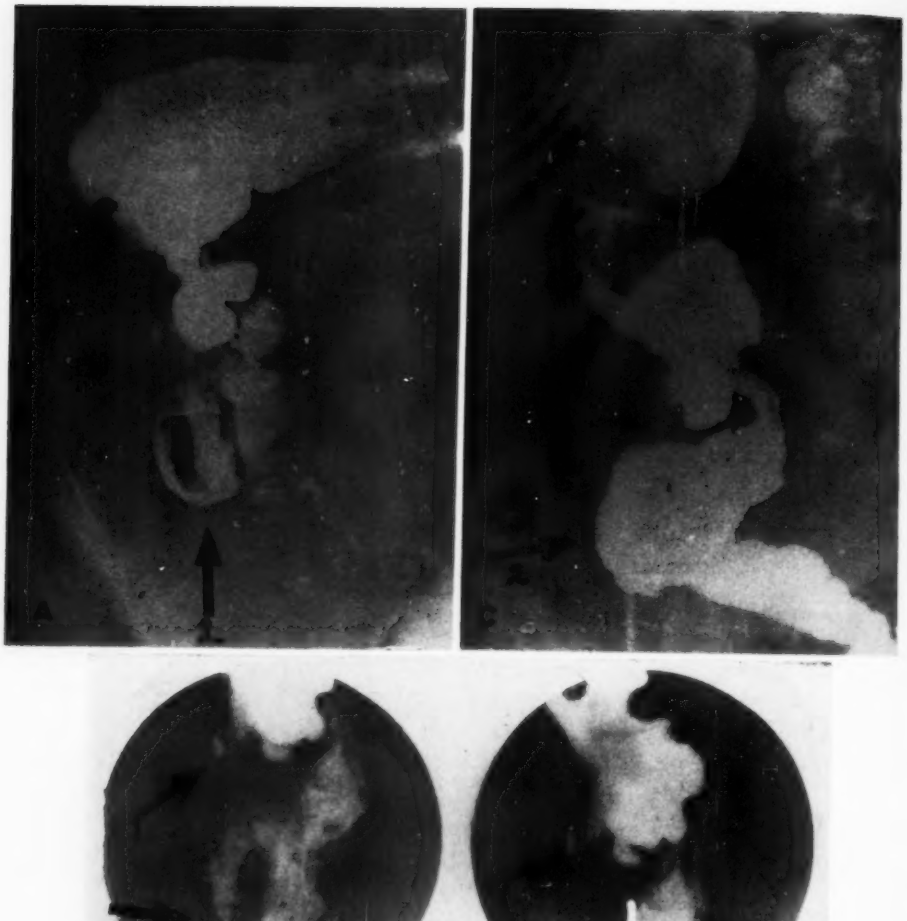

Fig. 1. Amebiasis of the Cecum with Fever as the Presenting Symptom and with No Change after Treatment.
For history, see opposite page.

(1) flask-shaped or undermined and (2) superficial, spreading over the surface of the mucosa; early lesions may be so small that they cannot be seen with the naked eye. In autopsy material obtained from 7 individuals who were accidentally killed in New Orleans, Faust (1941) found three types of ulcers: (1) pin-point ulceration, which is the initial lesion, (2) shallow, crater-like ulcers, and (3) extensive, shallow denudation of the mucosa. None of these ulcers extended below the muscularis mucosae and none showed evidence of bacterial invasion or of repair. However, Faust (1944) stated that the amebic lesion in chronic amebiasis is usually secondarily infected with bacteria.

SITE OF LESIONS IN THE LARGE INTESTINE

Amebic lesions may be present throughout the entire large intestine. They are likely to be most numerous or may be present only in the cecum and ascending colon and in the sigmoid and rectum. The ileum is rarely involved. Clark (1925) reported 186 postmortem cases in Panama, of which 159 died of amebiasis, including 95 instances of liver abscess. About 60 per cent of this series had lesions throughout the large intestine. In the 40 per cent with a local distribution the sites of the lesions in order of frequency were: (1) cecum and ascending colon, (2) sigmoid and rectum, (3) appendix. The cecum was involved either alone or with other portions of the large intestine in 88.7 per cent.

In 202 accident cases which came to necropsy in New Orleans, Faust (1941) found amebae in the intestinal contents in 13. The organisms were present in the cecum in 11 and the actual lesions were found in the mucous membrane in 7 cases, of which the cecum was involved in 6 and the ileum with the cecum in only one. In one instance lesions were present only in the cecum. None of the ulcers extended below the muscularis mucosae.

The ileum is rarely the site of amebic lesions, as suggested above. Clark (1925) does not mention involvement of the ileum in his series of 186 necropsy cases, most of which were severely infected. Craig (1934) stated that he had records of only 6 cases in which ulcerations were found above the ileocecal valve. However, Faust (1941) quoted Clark as having found the ileum involved in 9 (4.5 per cent) and the ileocecal valve in 4 (2.0 per cent) of 198 necropsy cases in Panama. Faust also quoted Connell as having found lesions in the ileum in 4 and on the ileocecal valve in one of 36 necropsy cases in New Orleans.

RADIOLOGY OF AMEBIASIS

Vallarino (1925) described "filling defects" in the large intestine associated with

Fig. 1. Case History.

A 46-year-old woman (Unit No. 715608) was admitted for study because of fever and weakness of more than three months' duration. Before admission she had seen twenty-six doctors, according to her statement. No cause for the continued fever has been found. The blood cell count showed: Hgb. 68 per cent, R.B.C. 3.7 million, W.B.C. 16,000, neutrophils 82 per cent. The liver was slightly enlarged. The blood phosphatase was 19.2 Bodansky units. The serum protein was 5.7. There was no history of diarrhea or abdominal pain. The patient's twenty-seventh doctor suspected amebiasis, asked for x-ray examination to find out whether the cecum was abnormal, and began a search for amebae. A small intestine study, Aug. 5, 1943, disclosed a slow transit time in the small intestine. The barium did not reach the cecum until nearly seven hours, although the patient was given food at four hours.

Fig. 1, *A*, is a spot film without pressure, which shows the small deformed cecum (1) and a coil of ileum (2) below the cecum, which could not be separated from the cecum. Moderate tenderness on pressure was present. The ascending colon is constricted just above the ileocecal valve.

B shows pressure films of the cecal tip (1) and the loop of ileum (2), which could not be straightened out by pressure. The ileum is not narrowed or constricted. Its mucosal folds appear obliterated or indistinct. These findings were considered consistent with amebiasis. Amebae were found in the stools. Emetine therapy was followed by disappearance of the fever, the patient's subjective condition improved, and the stools became negative.

C is a spot film of the right lower quadrant, Oct. 13, 1943, showing a change in the shape of the cecal tip, but little, if any, change in its size took place.

D shows pressure films taken at the same time showing the same immovable coil of ileum (2) below the cecum (1), which is slightly deformed by pressure. The mucosal pattern of the terminal ileum is now normal. The patient was feeling very well and had a ravenous appetite. It would be interesting to know whether the abnormal mucosal pattern of the ileum in *B* was due to amebic lesions in the mucosa or to edema resulting from hypoproteinemia and other nutritional disorders. This patient had traveled extensively in the United States but never beyond its continental limits.

TABLE I: SUMMARY OF MATERIAL

Total number of patients with suspected or proved amebiasis		119
With amebae in stools	107	
With no amebae demonstrated in stools on one or more examinations	8	
(One had superficial ulcers in the cecum on pathologic examination)		
With inadequate information concerning stools	4	
(One was proved by pathologic examination to have amebiasis)		
Number of patients having x-ray examination with barium		67
Barium by rectum	18	
Barium by mouth	27	
Both methods	22	
Deformed cecum		30
With positive stools	21	
With negative stools	7	
(One had superficial ulcers in the cecum on pathologic examination)		
With inadequate information about stools	2	
X-ray examination of patients with positive stools		58
No demonstrable abnormality	33	
Deformed cecum	21	
Other abnormalities of the colon	4	
X-ray examination of patients with negative stools or inadequate information about stools		9
No abnormality	0	
Deformed cecum with negative stools	7	
(One had superficial ulcers in the cecum on pathologic examination)		
Deformed cecum with inadequate information about stools	2	
X-ray examination of patients with diarrhea		33
Deformed cecum	18	
X-ray examination of patients with abdominal symptoms but no diarrhea		9
Deformed cecum	3	
X-ray examination of patients with no diarrhea or abdominal pain		18
Deformed cecum	4	
(This included one case with fever as the presenting symptom)		
X-ray examination of patients with inadequate information about abdominal symptoms		7
Deformed cecum	5	
(These were private patients whose complete records were not available)		
Amebiasis mentioned in x-ray report, with deformed cecum		22
Amebiasis mentioned in x-ray report, with deformed transverse colon		2
Wrong interpretation of deformed cecum		2
Called tuberculosis	1	
Called carcinoma	1	
Abnormality of cecum described but not interpreted		2
Abnormality of cecum present but not noted at time of examination		4
With positive stools	3	
With negative stools and rectal stricture	1	
Lesions distal to cecum		5
Deformed transverse colon alone with positive stools	2	
Deformed transverse, ascending colon and cecum with positive stools	1	
Rectal stricture alone, with positive stools	1	
Rectal stricture with deformed cecum, negative stools	1	
No x-ray examination		52
With positive stools	49	
With positive stools and diarrhea	28	
With positive stools and abdominal symptoms without diarrhea	6	
With positive stools and no abdominal symptoms	15	
With inadequate information about stools	2	
With negative stools	1	
No recorded abdominal symptoms referable to the intestine		34
With positive stools	34	
With abdominal symptoms		76
Diarrhea with or without blood	61	
Positive stools	56	
Negative stools	3	
Inadequate information regarding stools	2	
(One proved to be amebiasis by pathologic demonstration of lesions in cecum)		
Abdominal symptoms without diarrhea	15	
Positive stools	14	
Inadequate information regarding stools	1	

Inadequate information regarding symptoms		9
With negative stools and with cecal deformity	5	
With positive stools	3	
No x-ray examination	2	
X-ray examination with no cecal deformity	1	
With inadequate information regarding stools	1	
Cases having pathologic examination		5
Autopsy following pneumonia, positive stools, no x-ray examination, ulcers in ascending and transverse colon, cecum negative	1	
Autopsy following Hodgkin's disease, inadequate information about stools, x-ray examination with negative cecum, shallow ulcers in cecum, ascending colon and rectum	1	
Liver abscess with positive stools and no x-ray examination	1	
Liver abscess with positive stools, x-ray examination, barium by mouth, negative cecum	1	
Resection of cecum following erroneous diagnosis of carcinoma, negative stools. X-ray examination showed deformed cecum. Pathologic examination showed shallow ulcers in the cecum and proximal ascending colon but none in the ileum	1	
Travel record		
No record of travel far from New York area		17
Travel in the U. S. including Chicago 1933		16
Travel outside the U. S. (includes 2 who also had been in Chicago)		76
Coming from or travel to Latin America	44	
Travel occurred less than 10 years before examination	65	
Travel occurred more than 10 years before examination	11	
Inadequate information about travel		10
Sex ratio, total number		119
Males	81	
Females	38	
Age incidence		119
11–20 years	8	
21–30 years	22	
31–40 years	38	
41–50 years	24	
51–60 years	20	
61–70 years	4	
71–80 years	3	

amebiasis, which diminished following antiamebic treatment. They were more numerous in the cecum and ascending colon and in the sigmoid, although they were demonstrated in other portions of the colon as well.

Weber (1933) described the following changes on roentgen examination of the cecum in amebiasis: suppression of haustral markings, shortening and narrowing, and abnormal patency of the ileocecal valve.

Bell (1936) reported 7 cases of amebiasis with small deformed cecums. This deformity he believed should be considered as highly suggestive of this condition, though it might be simulated by tuberculosis limited to the cecum or by carcinoma. In two subsequent publications he confirmed these observations and reported additional cases. He also reported personal communications from deLorimier, from Reeves, and from King, who had observed similar cecal deformities in this condition.

MATERIAL

Several cases have been encountered at the Presbyterian Hospital in which the first suggestion that the patient might have amebiasis came from the demonstration of a deformed cecum. This led to a review of all of the available cases in which amebiasis was either proved or thought probably to be present. This material is reviewed and summarized in Table I. More than twice as many men as women were included in the group. The youngest patient was thirteen and the oldest seventy-eight, but the majority were between twenty and fifty years old, with the greatest incidence in the fourth decade.

Of the 119 patients whose records were reviewed, 107 had the *E. histolytica* in the stools. In one case with inadequate information about the stools, ulcers were demonstrated in the cecum and ascending colon with amebae in the tissues. Amebiasis, therefore, was proved to be present in 108 (90 per cent) of the 119 cases.

The stool examination in the vast majority of cases was done by a competent technician of many years' experience at the Presbyterian Hospital. A very few had a history of positive stools which was considered reliable.

No attempt was made to correlate the record of negative stools with the number of stool examinations. One examination of the stool (Craig and Faust) will disclose not more than one-third of the infections. Linders (quoted by Craig and Faust) believed that ten to twelve examinations are necessary to pick up approximately all the infections. Faust found that an unconcentrated film examination from three or four specimens obtained on alternate days and one zinc sulfate centrifugal flotation procedure gave a high percentage of accuracy. Three of the 8 patients whose stools are recorded as negative had only one examination, which is obviously insufficient. Information concerning the presence or absence of amebae in the stool was classed as inadequate if no search for these organisms was made, as occurred in 4 cases.

The roentgen examinations were done by various members of the staff, of varying degrees of experience.

It is of interest that 74 of the 119 were private patients, while 45 came from the wards or the Vanderbilt Clinic. All those who had been outside the continental limits were classed as having traveled outside the United States whether they were citizens who had temporarily visited or whether they were born in other countries. A number of the patients came from Latin America for medical care. A few had been in the Orient, North Africa, and Europe. Because it seemed likely that recent travel would be more significant from the epidemiological standpoint, the patients were divided into two groups; those who had been outside the United States (1) less than ten years and 2) more than ten years before the examination. The first group numbered 65 and included those who came to this country for medical care. In the second group of 11 individuals, the foreign travel is probably of considerably less importance. One patient was born in Switzerland and came to this country in childhood. He had to be included in the second group, although undoubtedly he acquired his infection here. As far as could be determined, 17 patients had not been away from the eastern seaboard in the New York area. Six of the patients who had traveled within the United States undoubtedly were infected in Chicago in 1933.

Sixty-one, more than half of the 119 patients, had diarrhea, and 15 had abdominal symptoms, usually pain, without diarrhea. Forty-nine of the 52 patients who had no x-ray examination had positive stools. Twenty-eight of the 49 also had diarrhea, while 6 had pain without diarrhea, and 15 had no diarrhea or abdominal symptoms ordinarily attributed to amebiasis. Casual common complaints of gas and constipation were not recorded as abdominal symptoms for this purpose. In this last group of 15 cases, the reason why the successful search for amebae was undertaken is not clear from the records. It is evident that diarrhea is the symptom most likely to raise the question of amebiasis in a general hospital in the temperate zone and to lead to a diagnosis without x-ray examination.

Thirty-three of the 61 patients with diarrhea had x-ray examination of the colon and 18 of them had a deformed cecum. Nine of the 15 patients with abdominal pain without diarrhea had x-ray examination of the colon and 3 had a deformed cecum. Eighteen of the 34 patients with no recorded intestinal symptoms had colon examinations and 4 had a deformed cecum; this group included an interesting case with fever as the presenting symptom (Fig. 1). Information concerning abdominal symptoms was inadequate in 9 cases, 7 of which had x-ray examination and 5 had a deformed cecum; one of the patients so classified died of Hodgkin's disease, and amebic ulcers were found at necropsy in the cecum, ascending colon, and rectum.

DISCUSSION

The analysis of this series of cases indicates that deformity of the cecum was

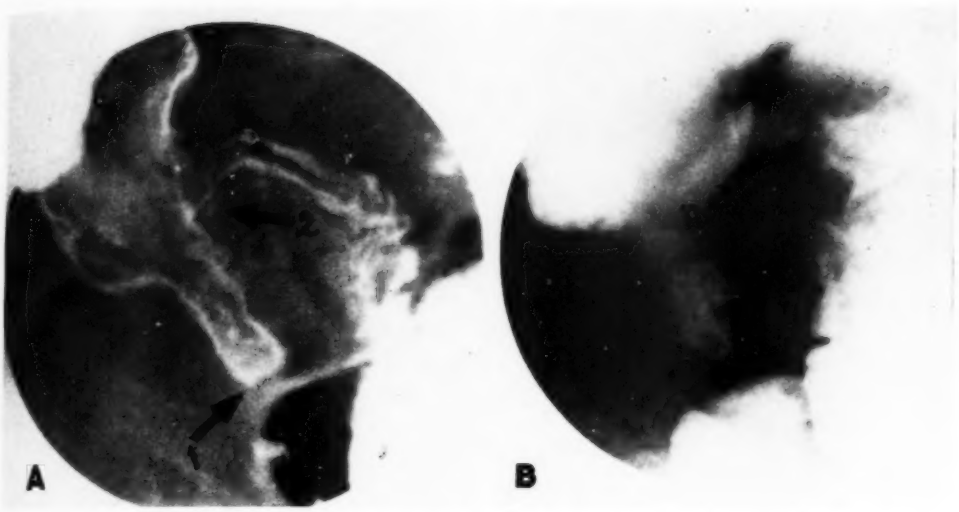

Fig. 2. Probable but Unproved Amebiasis of the Cecum Interpreted as Carcinoma, with Resection.

A man (Unit No. 587219) 53 years old, who was born in Switzerland but who had been in the United States since the age of 12, was admitted in 1938 for study. He complained of nausea of eight months' duration, weakness, fatigability, loss of 17 lb. in about three months, fever, and an indefinite sense of discomfort in the right lower quadrant. During 1908 he had several bouts of diarrhea, with "gas pains" in the right lower quadrant. In 1912 the attacks began again and continued intermittently until 1920, when they spontaneously ceased. Appendectomy was done without relief. On admission the liver was enlarged. The erythrocyte sedimentation rate was 92. The fever went up as high as 102.5°. Two stools showed positive tests for occult blood. One stool after a cathartic was examined for *Endamoeba histolytica* and none was found. X-ray examination disclosed a short deformed cecal shadow which was interpreted as "probably carcinoma with a remote possibility of tuberculosis." *A* and *B* are two pressure films of the cecum with an apparently normal terminal ileum. (Arrows: 1 is cecal tip; 2 is ileocecal junction.)

At operation, a lesion was found opposite the ileocecal valve which was not as large as anticipated nor as hard as carcinoma. No evidence of an inflammatory reaction could be seen. Ileocecal resection was done. Pathologic examination showed the serosa to be smooth and glistening. The wall of the cecum was thickened, varying from 0.4 cm. to 1.5 cm. in width, with fibrous tissue in its thickest portion. The base of the cecum was 5 cm. in width, tapering to a finger-like projection 2 cm. in width. The cecal mucosa was flattened, edematous, dull, immobile, and showed 8 shallow ulcers, none of which extended deeper than the muscularis mucosae In the lower part of the ascending colon was a similar diamond-shaped ulcer measuring 2 × 1 cm. The pathologist described these ulcers as not dissimilar to those of amebiasis, but no amebae could be demonstrated in the tissues. There was no evidence of carcinoma.

After operation the patient continued to run a fever, with occasional chills, with a leukocytosis up to 16,000, and with negative blood cultures. No explanation could be found. On the sixteenth postoperative day emetine therapy was started. Six days later the temperature suddenly became normal and the patient promptly got well. Two more stool examinations failed to disclose amebae. The clinicians thought the response to emetine suggested amebic hepatitis or possibly amebic abscess of the liver.

demonstrated in 30 of 67 patients having colon examination by barium methods. Cecal deformity occurred about five times as frequently in association with diarrhea and abdominal symptoms attributable to the intestine as with no such intestinal symptoms. The symptomless carriers are much less likely to have a deformed cecum than are those patients in whom the disease is severe enough to cause symptoms.

Twenty-one (36 per cent) of the 58 patients with the *E. histolytica* demonstrated in the stools had a deformed cecum. If this proportion holds, presumably 17 or 18 of the 49 patients with positive stools who had no x-ray examination of the large intestine would have shown deformity of the cecum if the examination had been done. Another patient with a deformed cecum had ulcers in the mucosa of the resected cecum and ascending colon, but amebae could not be demonstrated in the ulcers; postoperative fever and leukocytosis continued for twenty-two days, ceasing on the sixth day after treatment with emetine was begun (Fig. 2). In addition, 2 other patients with normal appearing cecums had deformity of the transverse colon and an-

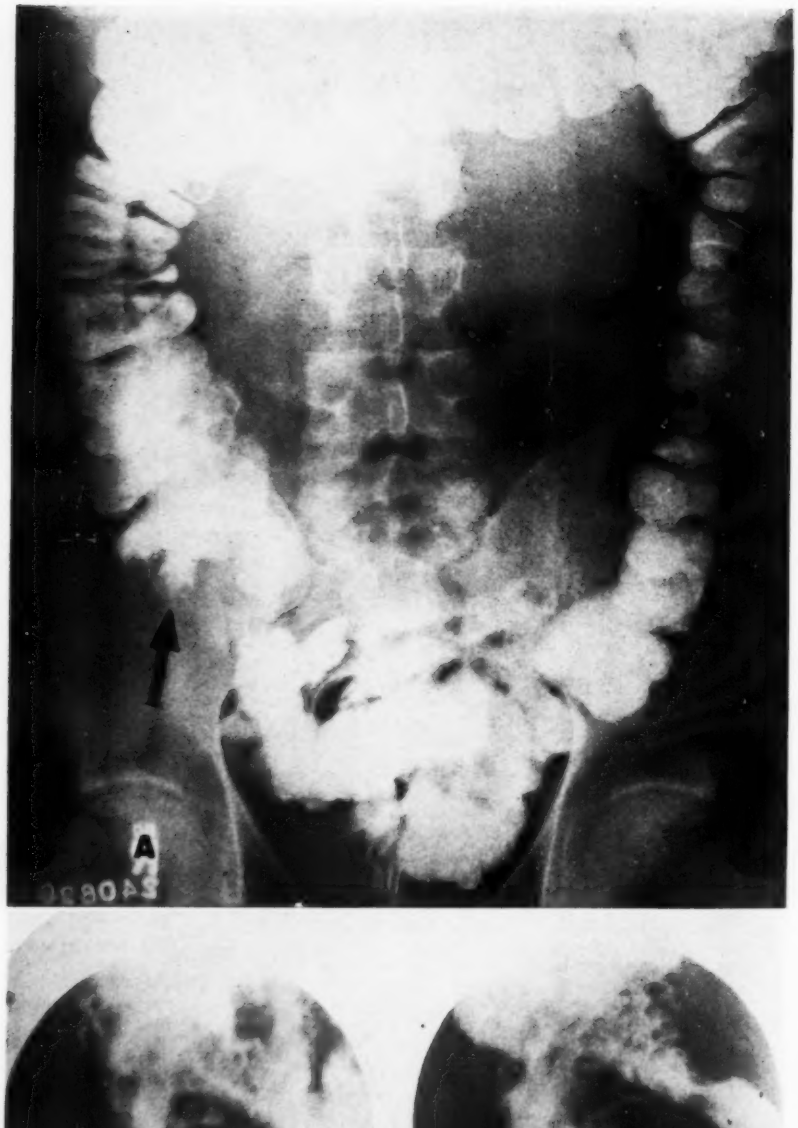

Fig. 3, A and B. Amebiasis of the Cecum with Improvement Following Oral Medication. See Fig. 3, C, for case history.

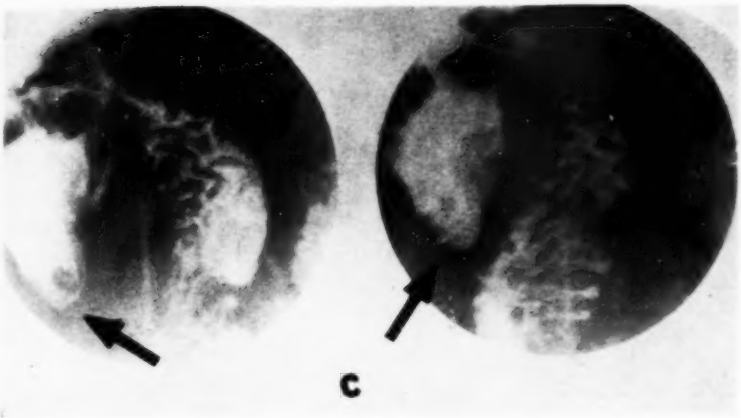

Fig. 3, C. Amebiasis of the Cecum with Improvement Following Oral Medication.

A man aged 36 (Unit No. 707511) was admitted April 22, 1943, because of recurrent diarrhea. He had lived in various parts of the world. Two years before admission, while living in a Latin American country, he had diarrhea for a month, which was thought to be bacillary dysentery. He was well for six months and then had a tapeworm. Five months before admission the diarrhea recurred and continued intermittently. When blood appeared in the stools he was given sulfaguanidine and the diarrhea stopped. Ten days before admission it began again, lasting five days, with "gas pains" and weakness. The patient lost 20 lb. in weight. On admission he felt well, and had no diarrhea, but stools contained mucus and flecks of blood. Sigmoidoscopy disclosed several depressed areas in the mucosa, which suggested healed ulcers. Exudate taken from around these depressions failed to disclose amebae and the physician thought amebiasis was excluded. A barium enema, April 21, 1943, disclosed hypertonicity and irritability of the sigmoid, and a deformity of the cecal tip. Fig. 3, *A*, is the post-evacuation film. Because no mass could be felt, this cecal deformity was interpreted as highly suggestive of amebiasis.

A few days later the patient was readmitted for further studies with barium by mouth. The morning of admission he passed a loose stool in which active amebae containing red cells were demonstrated. Barium was given by mouth, April 27, 1943. Fig. 3, *B*, shows two pressure films of the shortened, ragged-appearing cecum with a normal terminal ileum, taken at about four hours. The patient was given two courses of anayodin and returned to his business in a Latin American country. He was readmitted June 16, 1943, because of fever up to 104° with generalized aches and pains, which were at first attributed to grippe. The white cell count was 18,000 with 75 per cent neutrophils. The stools contained *E. histolytica*. Anayodin was started again and the patient was discharged June 26, with the temperature still elevated.

Another small intestine study was done July 26. Fig. 3, *C*, shows pressure films of the cecum taken at about four hours. The terminal ileum appears normal. The cecum is larger and smoother than in *B* but shows two marginal defects suggesting small elevations on the mucosa. Just below the ileocecal junction is a marked constriction. Although the cecum was improved in appearance, it was still abnormal.

The patient was readmitted July 27, with a fever of 100-101°. Emetine therapy was started, and six days later the temperature was normal. There was no clinical evidence of a liver abscess. Unfortunately no further x-ray studies were possible. The conduct of this case was definitely influenced by the x-ray demonstration of the deformity of the cecum.

other had a rectal stricture; all 3 had proved amebiasis.

No cecal deformity was demonstrated in 33 (57 per cent) of the 58 patients with positive stools who had examinations with barium. This shows clearly that failure to demonstrate an abnormality of the cecum or elsewhere in the colon is of no importance in excluding amebiasis.

Deformities distal to the cecum were present in the remaining 4 (7 per cent) of the 58 patients with positive stools.

Although we have no statistics to prove it, our experience indicates that cecal studies made following the ingestion of barium are more satisfactory and accurate than those made with the barium enema. The patient is not uncomfortable. Repeated observations with pressure films can be made. The terminal ileum can be studied at leisure. Care must be taken not to mistake incomplete filling for deformity of the cecum. However, the barium enema is necessary for the examination of the distal colon, the second commonest site for amebic lesions. The best procedure is to use both.

The cecal deformity varied considerably. In some cases it was slight and amounted to narrowing of the tip, an appearance well

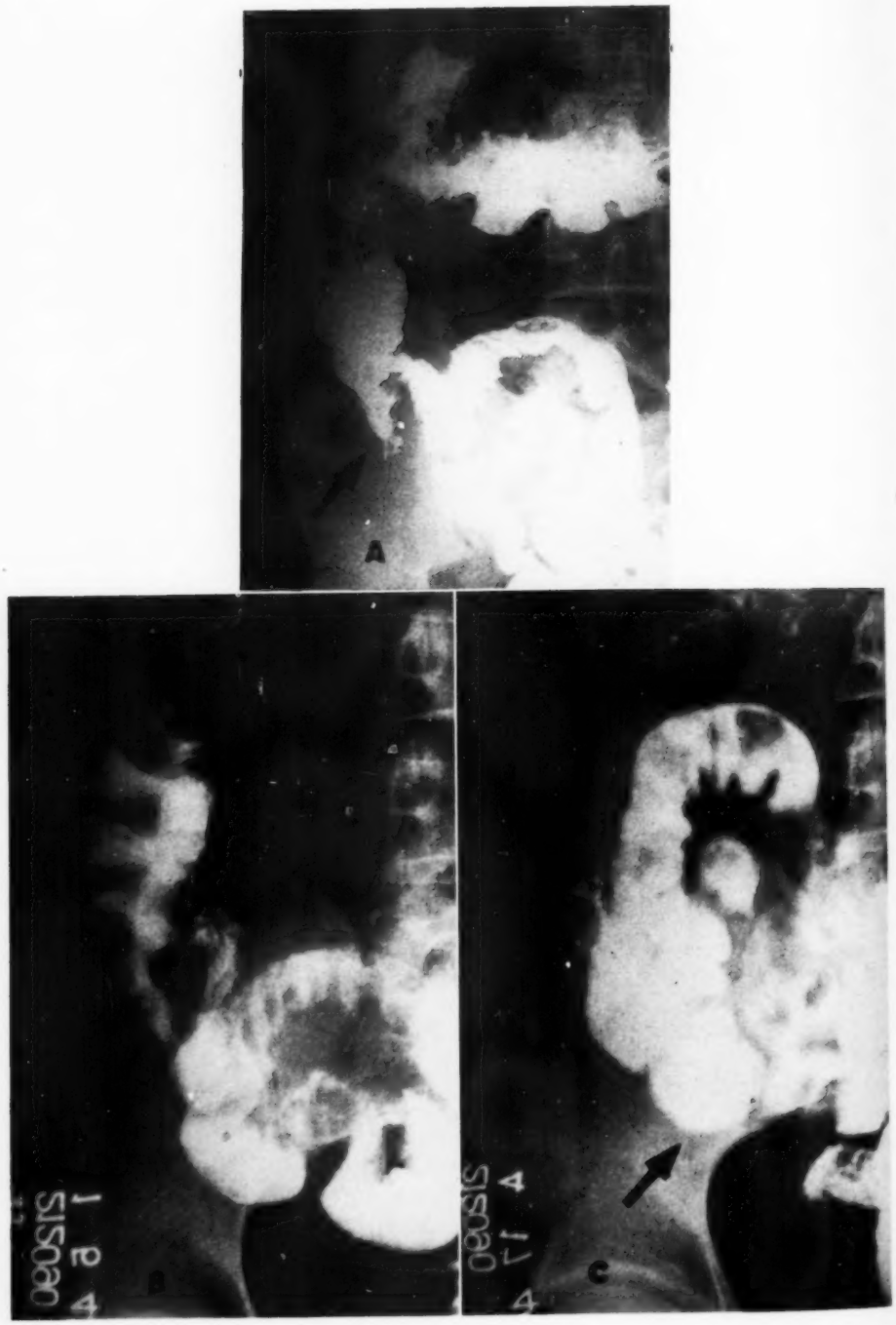

Fig. 4. Amebiasis with Deformity of the Cecum which did not Change Following Diodoquin but which Improved after Emetine.

For history, see opposite page.

illustrated in Bell's articles; in a few the cecum was so shrunken that its shadow measured only 2 or 3 cm. in diameter (Fig. 1). In the great majority the outline was smooth. Much less frequently the cecum was irregular in outline (Fig. 3) and narrow without much shortening (Fig. 4). The size and outline of the cecum often changed a little from time to time; this was particularly noticeable when the deformity was relatively slight. In some instances pressure on the cecum appeared to cause an increase in the deformity. Localized tenderness was usually elicited.

In none of the cases was the terminal ileum narrowed or intrinsically deformed. In very few it appeared to be immovable and was coiled in an abnormal position (Figs. 1 and 5). Lesions in the terminal ileum were not found in the 3 cases examined by the pathologists. In one case, although the lumen was not narrowed, the smoothness of the shadow and obliteration of the folds suggested edema of the mucosa (Fig. 1); this appearance disappeared after treatment. In a few cases the terminal ileum obscured the cecum. Spot films with and without pressure, with the patient rotated one way or the other, were sometimes necessary to separate the ileal from the cecal shadow. No case proved to have amebic lesions in the ileum has been reported in which barium studies were done, as far as we know. Therefore, we do not know what, if any, abnormality demonstrable by x-ray methods might be expected in the ileum in such a case.

EFFECT OF TREATMENT

As pointed out by Bell, the small deformed cecum may relax and increase in size with anti-amebic treatment. Re-examination was done after treatment in only 5 of our cases. In 4 of them, relaxation of the cecum, suggesting improvement, was demonstrated. Figure 3 illustrates improvement following oral therapy, but the cecum did not become normal and, although diarrhea stopped, fever continued until a series of injections of emetine was given. Unfortunately another re-examination was not done. In Figure 4 little change in the cecum occurred following oral therapy, but marked improvement resulted from a combination of emetine and diodoquin. In another case (Fig. 1) with extreme shrinking of the cecum, little change in its size or shape could be demonstrated following the specific treatment, which produced complete relief of symptoms. It would seem that in later stages the changes produced by the disease are irreversible.

CAUSE OF THE CECAL DEFORMITY

Abnormality of the cecum demonstrable by roentgen methods is not present in nearly two-thirds of the cases of amebiasis, although the great majority of them undoubtedly have lesions in the cecum. However, in over one-third of the cases, cecal deformity is present. The reason it appears in one case and not in another is not clear. Inasmuch as cecal deformity is present more than five times as frequently in patients with diarrhea or other intestinal symptoms as in those with neither, it seems probable that the severity of the infection and, therefore, the number of lesions may play a part. No observations are available to indicate how soon after infection cecal deformity may appear. The fact that the small cecum relaxes under treatment indicates that the deformity is due in part at

Fig. 4. Case History.

A 35-year-old man (Unit No. 639076) was admitted Nov. 15, 1943, because of pain in the right lower quadrant and watery diarrhea. A barium enema, Nov. 15, and a small intestine study, Nov. 18, disclosed narrowing and deformity of the cecum. Fig. 4, *A*, is the six-hour film. The terminal ileum was not abnormal. Amebiasis was suggested in the report. Three stool examinations were negative and the fourth was positive. Diodoquin was given from Nov. 30 to Dec. 10. A stool on Dec. 17 was negative.

Pain and tenderness in the right lower quadrant recurred and the patient was readmitted Jan. 4, 1944. A barium enema Jan. 5, 1944 (*B*), showed the cecum to be a little longer but no wider than it was on Nov. 18, 1943. A course of emetine was given, followed by a course of diodoquin, with relief of symptoms. A barium enema Feb. 15, 1944, showed relaxation of the cecum. *C* is the postevacuation film following a barium enema April 17, 1944. The cecum was much larger and regular in outline.

Fig. 5. Amebiasis of the Cecum with No Diarrhea.
For history, see opposite page.

least to spasm. The amebic lesions in early stages are confined to the mucous membrane. In the small intestine it has been shown that mechanical stimulation of the mucosa causes relaxation of the muscularis. Stimulation of the mucosa alone by the lesions would probably not tend to cause spasm. The information available concerning the pathology of this disease indicates that early lesions confined to the mucosa are not associated with secondary infection. On the other hand, Faust stated that in chronic amebiasis secondary bacterial infection is usually present. It seems possible, therefore, that after the ulcers penetrate into the submucosa and a secondary infection occurs, then spastic contraction of the cecum may be caused by direct irritation of the muscularis. On the other hand, it seems improbable that cecal deformity would be caused by uncomplicated superficial mucosal ulcers alone. In 2 of our cases the coiling and immobility of the terminal ileum suggested that the inflammatory process had extended into the peritoneum. However, much more work needs to be done in detailed studies of the pathology in cases with deformed cecums before the mechanism of the deformity can be understood.

DIFFERENTIAL DIAGNOSIS

Deformity of the cecum may be produced by carcinoma, by tuberculosis, and by regional enteritis.

Tuberculosis involves both the cecum and the ileum in the vast majority of cases, is confined to the ileum alone infrequently, and to the cecum alone in less than 5 per cent of the cases. The demonstration of a normal terminal ileum is strong evidence against tuberculosis. However, as Bell pointed out, hyperplastic tuberculosis of the cecum could simulate the cecal deformity described above. We have seen hyperplastic tuberculosis of the cecum in only 2 cases, and the ileum was involved in both.

Likewise, regional enteritis involves the cecum infrequently and the ileum commonly. We have not seen a case of regional enteritis confined to the cecum. In both tuberculosis and regional enteritis the terminal ileum is narrowed or irregular in outline.

Carcinoma of the cecum usually produces an irregular asymmetrical filling defect associated with a palpable mass, whereas the deformity of amebiasis is symmetrical and in the majority of cases is smooth and regular and is not associated with a palpable mass. In most of them the deformity may change a little from time to time, whereas the defect of carcinoma is usually unchanging. A mass produced by a large amebic granuloma of the cecum could not be differentiated from carcinoma.

Amebiasis of the cecum appears to be more frequently encountered in the patients seen at the Presbyterian Hospital than carcinoma or tuberculosis of the cecum. In the ten years preceding Dec. 31, 1943, the record room files show 67 cases of carcinoma of the cecum and only 12 of ileocecal tuberculosis.

Errors in interpretation in our series were few, as amebiasis was mentioned in the report of the roentgen examination in 22 of 30 cases with cecal deformity. In 2 cases the deformity of the cecum was interpreted as carcinoma (Fig. 2) and tuber-

Fig. 5. Case History.

The 40-year-old wife of a doctor in one of the West Indies islands came to New York for medical care because of intermittent right lower quadrant pain of seven years' duration, which was increasing in severity. There was no history of diarrhea. Fig. 5, *A*, shows the right lower quadrant about four hours after the ingestion of barium. The terminal ileum and the ileocecal junction can be identified without difficulty. Ileal loops are superimposed in the cecal region in such a way that the cecum cannot be identified. By rotating the patient to the left the cecum could be seen.

Fig. 5, *B*, shows two spot films without pressure. The cecum (1) is peculiarly deformed. A loop of lower ileum is superimposed upon it. The cecum and adjacent ileal loops were immovable (ileocecal junction, 2; terminal ileum, 3). Because of the deformed cecum, a search for amebae was suggested and the organisms were quickly found. Treatment was followed by symptomatic relief.

The demonstration of the cecal deformity saved this patient an exploratory operation. Undoubtedly pericecal adhesions are present, which involve adjacent ileal loops. This made the identification of the deformed cecum difficult. The case illustrates the importance of careful fluoroscopy with spot films.

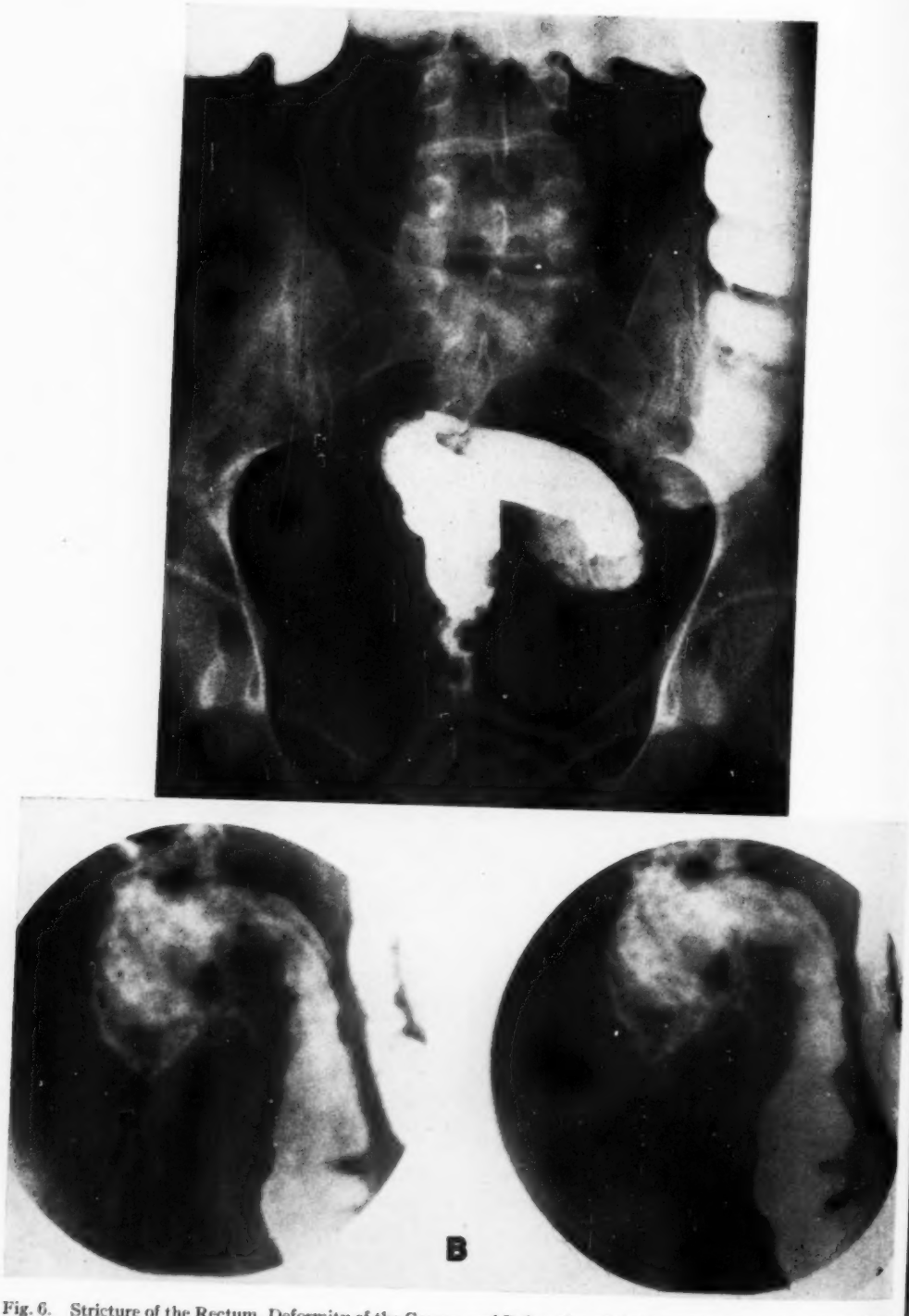

Fig. 6. Stricture of the Rectum, Deformity of the Cecum, and Relaxation of the Ileocecal Valve with No Positive Proof of Amebiasis.

For history, see opposite page.

culosis, respectively. The one error was unfortunate, as it led to an unnecessary operation. Both errors were apparently made because the observers did not think of the possibility of amebiasis. In 2 reports, abnormality of the cecum was mentioned but was not interpreted, probably because the observers did not know what to say but were convinced the disease was neither malignant nor tuberculous. In 4 instances the observer apparently did not see the deformity. In only 2 instances in our series was deformity of the cecum associated with other lesions in the large intestine; in one case the rectum (Fig. 6) and in the other the ascending and transverse colon was involved. Flexible narrowing or irregularity of the wall distal to the cecum can be taken as additional evidence that the cecal deformity suggests amebiasis. Clark's necropsy statistics suggest that with the heavy infections which occur in some geographic regions multiple areas of involvement might not be as infrequent as in our series of cases.

Probably the greatest difficulty lies in the recognition of the milder stages of the deformity. How great is the danger of mistaking functional changes in the shape of the cecal tip for the spasm induced by amebiasis? Contraction of the cecum under the stimulus of pressure is not at all infrequent. This reaction is usually present in the well advanced deformities unquestionably associated with amebiasis. Can irritation from the appendix produce a spasm of the cecal tip? Suppose the cecum appears normally filled out and rounded at the six-hour period and at twenty-four hours appears small and pointed, can this be taken as evidence of disease? These and similar questions are puzzling at the present time; many careful correlations with clinically proved cases will be necessary before they can be answered.

We have the impression that a deformity which is not persistent is probably not significant. If a cecum contracts under the stimulus of pressure and promptly relaxes, the movement is probably normal. On the other hand, if the cecum contracts under pressure and stays contracted, particularly if it seemed a little small before it contracted, and if localized tenderness is present over the cecal tip, it seems reasonable to raise the question of amebiasis. This should be presented to the clinician as a suggestion, not as a diagnosis, and should be so accepted by him.

The difficulty of demonstrating the organisms in the stools of some patients, particularly those with obscure atypical symptoms due to amebiasis, is well recognized. Schulze and Ruffin (1942) called attention to the fact that other disease may coexist with amebiasis. These writers believe that a trial of specific therapy is justified to prove the diagnosis in suggestive cases in which the organism cannot be demonstrated.

It is of interest that in standard textbooks (*e.g.*, Craig and Faust), and in authoritative articles (*e.g.*, Faust, 1944) no mention is made of barium procedures as a method of demonstrating amebic lesions in the large intestine. Schulze and Ruffin (1942) stated: "Barium studies of the colon are sometimes suggestive but rarely, if ever, justify diagnosis." They did not describe what abnormalities of the barium shadows of the colon they would accept as suggestive of amebiasis. In this sense a filling defect in the stomach does not justify a diagnosis of carcinoma because other diseases such as syphilis or lymphosar-

Fig. 6. Case History.

A 42-year-old woman (Unit No. 522696) was admitted because of alternating constipation and diarrhea, and rectal bleeding. A barium enema (Fig. 6, *A*) disclosed narrowing and irregularity of the rectum. Barium by mouth disclosed shrinking and deformity of the cecal tip with a normal terminal ileum (*B*). The ileocecal valve was widened and relaxed.

This is one of the relatively few cases in this series which showed the abnormality of the ileocecal valve described by Weber. Amebiasis was suggested. One stool examination was negative for amebae. Biopsies from the rectum showed evidence of inflammation, but no amebae could be identified in the tissue. The Frei test was negative. The surgeon is not inclined to accept amebiasis as the probable explanation for this disease, and nothing further has been done to prove the diagnosis.

coma may also produce it. Furthermore, carcinoma may be present with no demonstrable deformity of the stomach. Yet the clinical value of the roentgen examination of the stomach cannot be denied. Because the barium method of examination of the digestive tract is so universally used, it is quite likely to be applied in cases with obscure abdominal symptoms such as those described by D'Antoni and others in amebiasis. If the significance of cecal deformity without narrowing or irregularity of the terminal ileum is recognized, a number of cases of amebiasis will be found which otherwise would escape detection. At the same time it must be emphasized that the procedure has no value whatsoever in ruling out this disease.

SUMMARY

A group of 119 cases of proved or suspected amebiasis was studied. Of these, 67 had x-ray examination with barium, which disclosed deformity of the cecum in 30. Twenty-one of the 30 had proved amebiasis. In the other 9 cases the disease was not disproved. Of 58 patients with amebae in their stools, 33 had no abnormality of the cecum demonstrable by x-ray methods. Experience with this series suggests that recognizable deformity of the cecum is likely to be present in over one-third of the cases of amebiasis. Cecal deformity is much more likely to be found in patients with than in those without intestinal symptoms. Its absence is of no value in ruling out amebiasis, as deformity was not found in almost two-thirds of the patients with this disease.

Recognition of the cecal deformity has proved clinically valuable in a number of cases in which the first suggestion that amebiasis might be present came from the x-ray examination.

Inasmuch as amebiasis is not uncommon in temperate climates and as it will probably be found more frequently with the return of our military forces from all parts of the world, it seems evident that the significance of cecal deformity deserves attention.

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Roentgen Findings in Amebic Disease of the Liver[1]

MAJ. FRANK ISAAC, M.C., A.U.S.

AMEBIC DISEASE of the liver is the most common complication of amebic dysentery. It is far more common among visitors to the tropics than among the native population. The ratio is often put at 10 or 20 to 1. Of 222 cases of amebic dysentery reviewed, 32, or 14 per cent, showed liver involvement.

The purpose of this paper is to emphasize—or perhaps to re-emphasize—certain pertinent facts about the diagnosis of amebic liver disease, in the light of experience in an Army Hospital. The writer makes no claim to originality for his observations. Because of the obvious difficulties in an overseas theatre, the literature on the subject has not been reviewed.

Two stages of the disease have been seen at this hospital. The first stage is a diffuse hepatitis, similar to hepatitis of other origin, except that very few cases of amebic etiology show clinical jaundice. This is the earliest stage of the disease; no pathognomonic signs exist and the diagnosis is dependent upon a carefully taken history, suggestive physical signs, and sometimes a therapeutic test.

The stage of hepatitis may or may not progress to the second stage, that of a full-blown abscess or multiple abscesses. It is often difficult, or even impossible, clinically to differentiate between the two stages. If early specific treatment is instituted, it may never become definitely established whether or not actual abscess formation has been present. For this reason, and because aspiration of an abscess was indicated in only a very small percentage of cases, it has been the custom at this hospital to make no distinction between the two stages for purposes of classification. Unless aspiration became necessary and pus was actually obtained, all cases of amebic disease were designated as amebic hepatitis.

[1] Accepted for publication in May 1945.

CLINICAL COURSE

The *Endamoeba histolytica* reaches the liver through the portal circulation from ulcerations in the mucosa of the colon. Obviously, then, amebic dysentery must always precede hepatitis, although sometimes no such history can be elicited.

The onset is usually insidious. The patient may not appear very ill. He complains of anorexia, malaise, and vague discomfort in the epigastrium, radiating to the right hypochondrium and sometimes to the right shoulder. There is almost always a history of previous short attacks of diarrhea, sometimes going back four to six months. A low-grade fever and moderate leukocytosis are invariably present and the sedimentation rate is elevated. The liver may or may not be palpable, but there is invariably tenderness over the hepatic area. Pain can often be elicited on anteroposterior compression of the right lower chest.

At times, the onset may appear to be very sudden and the clinical course of the disease stormy. The patient may appear gravely ill with a high spiking fever and a large, palpable, tender liver.

ROENTGEN FINDINGS

On x-ray examination, two groups of cases will be found. In one group, comprising approximately 50 per cent of the cases, either there are no x-ray signs whatever, or there may be a downward enlargement of the liver, as shown on a survey film of the abdomen by displacement of the liver edge to a variable distance below the costal margin. The film should be made with the patient in the prone position, at the end of expiration. These cases are undoubtedly those of diffuse amebic hepatitis, similar to hepatitis of other etiology except that they respond dramatically to emetine.

In the second group of cases we find

frank liver abscesses with positive x-ray signs on the chest film. Of the 32 cases here reviewed, only 22 were examined roentgenologically. Of these, 10, or 45 per cent, showed positive evidence of liver disease on the chest film. The right dome of the diaphragm is elevated, usually for at least one interspace. Only the outer portion of the leaf may be raised, so that the costophrenic sinus is flattened out, but the cardiophrenic angle may be intact. Or only the mesial portion may be high, so that the cardiophrenic angle is obliterated. At times, elevation is limited to the midportion of the leaf, as though the upward convexity of the dome were markedly accentuated. In this latter instance both the costophrenic and cardiophrenic angles are sharpened.

When present, elevation of the right diaphragm is the most unequivocal sign of amebic liver abscess. It not only clinches the diagnosis, but it is most valuable in checking on the therapeutic results. It will be found that, while clinical response to specific treatment may be dramatic, the x-ray signs will be much slower in returning to normal.

On a lateral view of the chest, besides the elevation of the right diaphragm, a more localized bulge may sometimes be made out, usually in the anterior half of the dome, directed upward and forward.

If the patient is examined fluoroscopically, it will be found that the right diaphragm either shows no excursions at all or its movements are very sluggish, the right dome descending only slightly as compared with the left.

The right lower lung field sometimes shows secondary changes. The bronchovascular markings in the right base may be crowded, and at times the picture resembles that of a primary atypical pneumonia, except for the abnormality of the diaphragm. The condensation of the lung markings is probably due to compression by the high diaphragm. The infiltration, on the other hand, is probably to be attributed to interstitial pneumonitis or perhaps to partial atelectasis. In a certain percentage of cases a frank pleural reaction is seen in the right costophrenic angle; a narrow band of thickened pleura is seen running up toward the axilla and there may be a small amount of fluid in the costophrenic sulcus. These are probably cases of liver abscess which have ruptured into the pleural cavity. Often, under these circumstances, the underlying amebic disease is not suspected clinically. All the symptoms and physical signs are referable to the chest, and the diagnosis may first be made on the x-ray evidence.

From a roentgenologic point of view, then, it may be said that in regions where amebic dysentery is prevalent, abnormal elevation of the right diaphragm should always make one suspect amebic disease of the liver.

CASE REPORTS

CASE I: Ch. L., white, 38 years old, was admitted to the hospital June 10, 1943, with a history of anorexia and pain in the umbilical region of four days' duration. Pain was constant and radiated to the right upper quadrant. There was no vomiting or diarrhea. The liver was palpable two fingers breadth below the costal margin and very tender. The temperature varied between 99 and 102° F., and there was a moderate leukocytosis. Stools were negative for *E. histolytica* on ten successive examinations.

X-ray examination on June 15 revealed a slight elevation of the right dome of the diaphragm (Fig. 1, A). Costophrenic sinuses and lung fields were clear. Re-examination on June 22 showed the right diaphragm to be in a slightly higher position (Fig. 1, B). There were increased lung markings throughout the lower half of the right lung field, probably due to compression. Fluoroscopic examination of the chest on the same day showed the right diaphragm moderately elevated and almost completely immobilized. Only its mesial portion showed very slight movement. A survey film of the abdomen of the same date showed the liver edge displaced downward, 5 cm. below the costal margin (Fig. 1, C).

A diagnosis of amebic liver abscess was made and specific treatment instituted. The patient responded well to emetine therapy (Fig. 1, D) and was discharged to duty on July 22, "improved."

CASE II: J. J., colored, 36 years old, was admitted on Aug. 18, 1943, with a chancroid lesion of the penis and regional lymphadenitis. During his stay in the hospital he began to run a high spiking temperature, fluctuating between 99.5 and 104° F., with daily remissions. X-ray examination of the chest on Aug. 25 and 26 revealed elevation of the

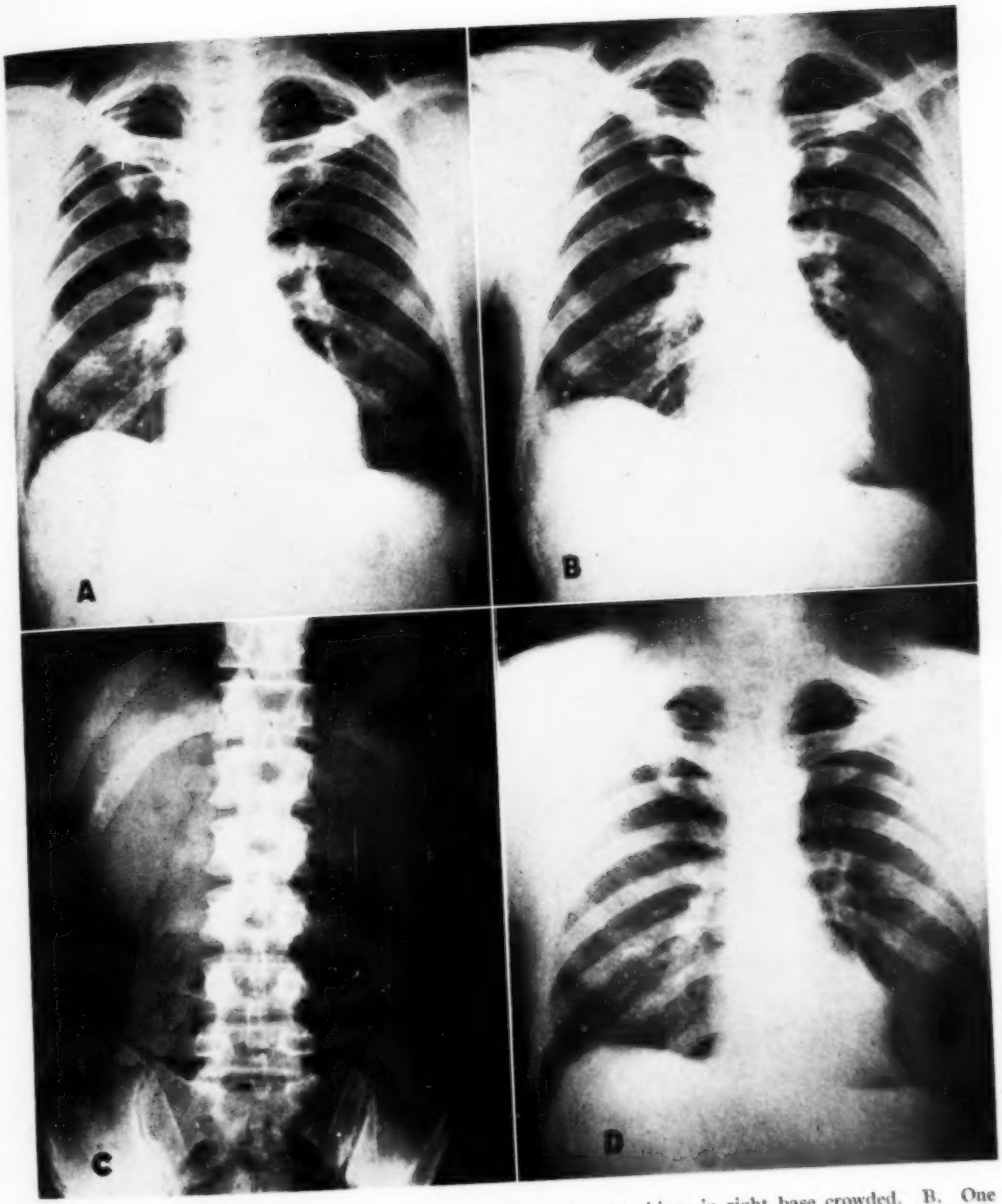

Fig. 1. Case I. A. Right diaphragm in high position; lung markings in right base crowded. B. One week later: right diaphragm higher; costophrenic sinus obliterated. C. Same day as B: Liver edge about 5 cm. below costal margin. D. Right dome lower, following emetine therapy, though not yet entirely normal in position; costophrenic sinus clear.

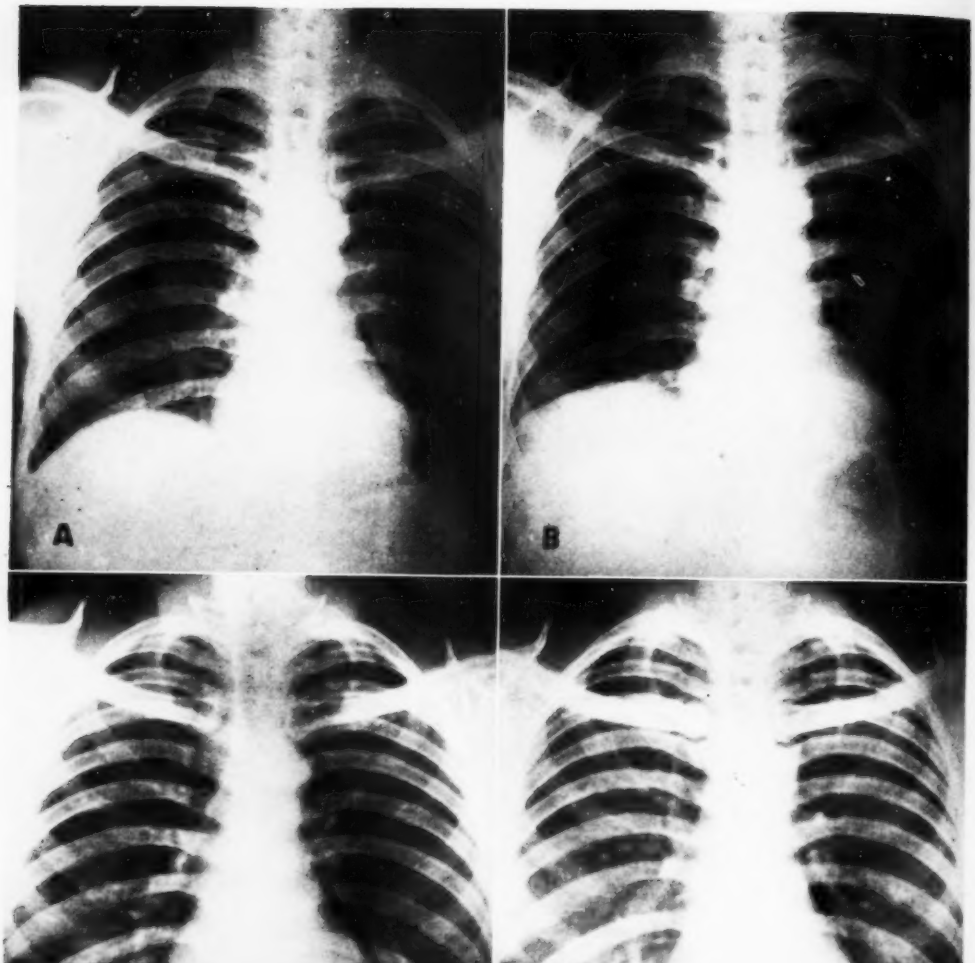

Fig. 2. Case II. A. Moderate elevation of right diaphragm. B. Next day: Right diaphragm much higher; costophrenic sinus flattened out. C. Diaphragm lower following emetine therapy. D. Right diaphragm normal in position.

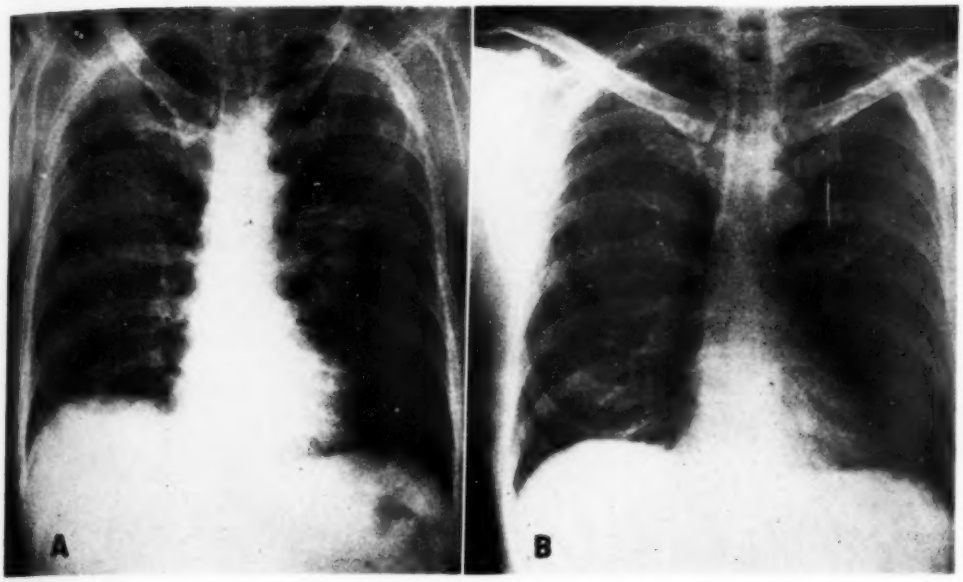

Fig. 3. Case III. A. Elevation of right diaphragm. B. One month later: right dome in normal position, one whole interspace lower than in A.

right diaphragm, with blunting of the costophrenic sinus (Fig. 2, A and B) and increased markings in the right base, probably due to compression. The left diaphragm was also elevated by a distended colon. The diagnosis was amebic abscess of the liver. Specific treatment was started. The patient responded well to emetine (Fig. 2, C and D) and was discharged to duty on Oct. 17. The venereal lesions cleared on concurrent sulfathiazole therapy.

CASE III: Ch. G., white, 46 years old, was admitted on March 29, 1944, after a month in a base hospital, where no definite diagnosis had been made. He complained of pain in the epigastrium and right upper quadrant, nausea and vomiting, and fever, of over a month's duration. Diarrhea, present at the onset of his illness, had ceased. The liver was palpable two fingers breadth below the costal margin and tender on pressure. Pain was aggravated by deep breathing or lying on either side. Severe pain was elicited by anteroposterior compression of the right lower chest. There was a leukocytosis, and the sedimentation rate was increased (26 mm. in one hour). Stool examination was positive for *E. histolytica*.

Films of the chest and right abdomen taken on March 30, showed a slight elevation of the right diaphragm, especially in its mesial half (Fig. 3, A). The costophrenic sinuses and lung fields were clear. The liver edge was seen about 4 cm. below the costal margin. Three courses of emetine were given with gradual subjective improvement, decrease of the sedimentation rate, and return of the liver to normal size, though it remained tender. X-ray examination on April 30 showed the right diaphragm normal in outline and position (Fig. 3, B). The liver edge at the end of expiration was about 1 cm. below the costal margin. The patient was discharged to duty June 16, 1944, "improved."

CASE IV: C. G., 36 years old, was admitted to the hospital Sept. 12, 1944, with fever, anorexia, vomiting, and epigastric pain of five days' duration. He gave a history of diarrhea three months previously and, at the time of admission, was passing two watery stools each night. Examination was negative except for tenderness in the epigastrium and right upper quadrant. The liver was palpable two fingers breadth below the costal margin. The temperature varied between 103.5 and 99.5° F. The icteric index was 3.9. The sedimentation rate was elevated (65 mm. in one hour). The white blood cell count was 13,600, with 90 per cent polymorphonuclears. A malaria smear was negative. Stool examination was negative for *E. histolytica*.

X-ray examination, on Sept. 13, showed both sides of the diaphragm normal in outline and position (Fig. 4, A). The costophrenic sinuses and lung fields were clear. On Sept. 21 films of the chest and right abdomen showed a moderate elevation of the right diaphragm, especially in its mesial half (Fig. 4, B). The liver edge was displaced downward about 4 cm. below the costal margin. A diagnosis of amebic hepatitis was made and the patient was placed on emetine therapy. There was no response to a course of 6 daily injections of one grain. A

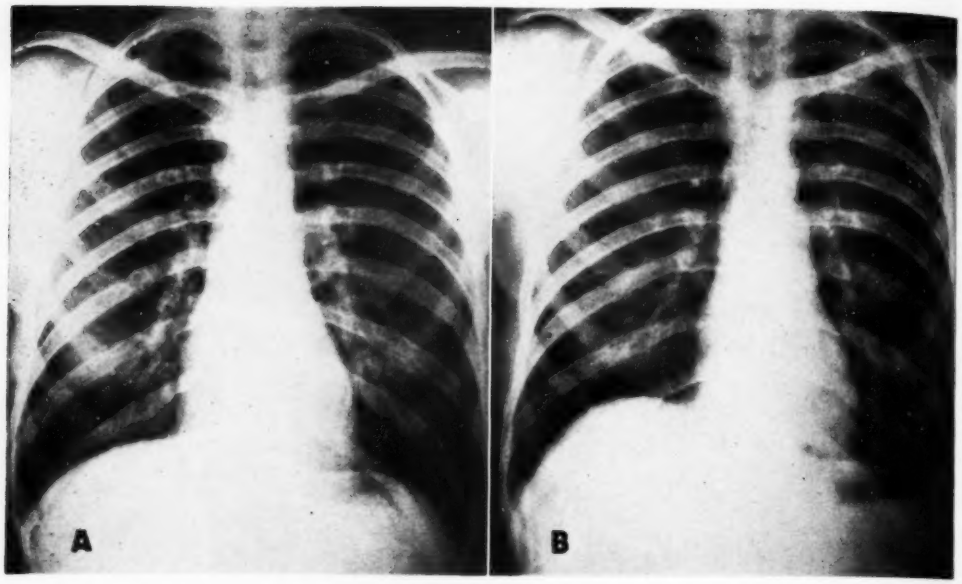

Fig. 4. Case IV. A. Right diaphragm approximately normal in position and outline (Sept. 13). B. Moderate elevation of right dome in mesial half (Sept. 21). See also Fig. 4, C.

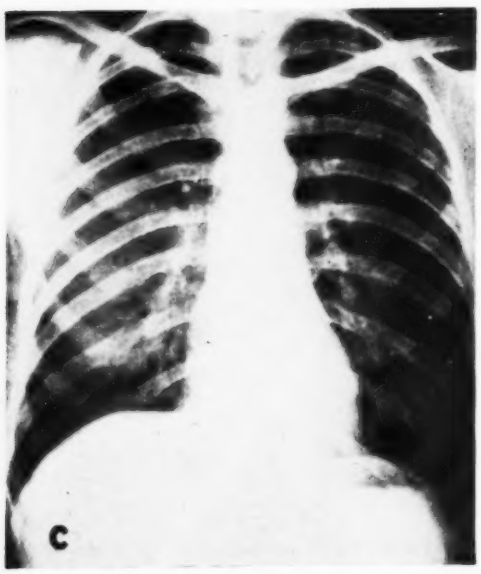

Fig. 4, C. Case IV. Oct. 9: Right diaphragm still elevated, but less than on earlier examination.

second course was given and gradual clinical improvement followed. Roentgen examination of the chest and abdomen on Oct. 9 showed the right diaphragm still somewhat high in position (Fig. 4, C), although to a lesser extent than previously. The liver edge was now seen 2 cm. below the costal margin. The patient was discharged to duty on Oct. 22, 1944, "improved."

CASE V: F. R. J., 44 years old, was admitted Sept. 13, 1944. The onset of illness was five days previous to admission, with severe pain in the right flank, general weakness, and profuse sweats. The right flank pain was intermittent, stabbing in character, and radiated through the right chest and to the right shoulder. The patient complained of frequency of urination and nocturia (three or four times a night). He had experienced no urinary symptoms prior to the onset of the illness. Physical examination showed marked pallor and deep tenderness in the right flank, but was otherwise negative. The temperature was 100.5° F. on admission and fluctuated between 104 and 100° F. for the next few days. The white blood cell count was 16,500 with 84 per cent polymorphonuclears. The sedimentation rate was elevated. Urinalysis showed 1 + albumin, 8 to 10 white blood cells, and 6 to 8 red cells per high-power field. The blood pressure was 122/70. The patient was thought to have a severe perinephritis without evidence of perinephritic abscess. An excretory pyelogram, made Sept. 20, showed rather poor concentration by both kidneys, but was otherwise negative.

X-ray examination of the chest on Sept. 22 showed the right diaphragm high in position (Fig. 5). There was considerable mottling in the right base and costophrenic sinus, apparently representing pneumonitis. The x-ray opinion was: amebic dis-

case of the liver with secondary pneumonitis in the right base. Emetine treatment was instituted and the response was dramatic. The temperature promptly subsided, pain and tenderness disappeared, and the sedimentation rate dropped to normal. The patient was discharged to duty on Oct. 14, 1944, "cured."

SUMMARY AND CONCLUSIONS

Amebic disease of the liver is the most common complication of amebic dysentery. Of a series of 222 patients with amebic dysentery, 32 (14 per cent) had amebic disease of the liver.

Two stages of the disease can be distinguished: amebic hepatitis and amebic liver abscess. Differentiation between the stages is not always possible clinically.

In cases of hepatitis survey films of the abdomen show either no positive x-ray signs or only a downward displacement of the liver edge to a variable distance below the costal margin.

In regions where amebic dysentery is prevalent, elevation of the right diaphragm, with complete immobilization or diminished excursions, is a pathognomonic sign of frank liver abscess.

Pneumonitis in the right base, associated with a high right diaphragm, is probably secondary to amebic liver abscess, if other causes for the elevation of the dome can be ruled out.

Pleural reaction with or without a small effusion in the right costophrenic sinus in the presence of a high diaphragm is secondary to liver abscess and may indicate rupture of the abscess into the pleural cavity.

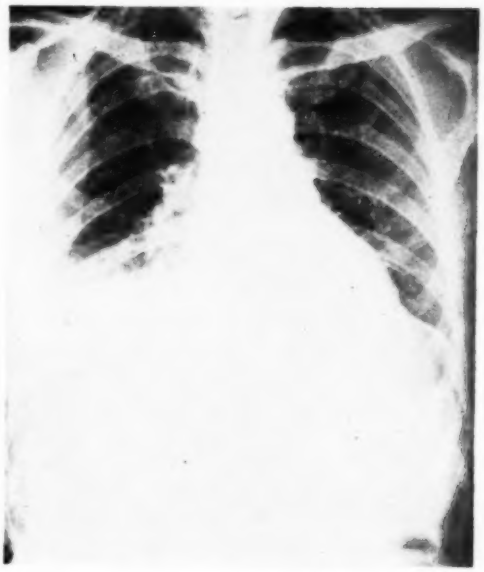

Fig. 5. Case V. Right diaphragm flattened and in high position. The right hilar shadow is enlarged and there is streaked and mottled pneumonic infiltration extending into the right base.

Most cases of amebic liver disease, whether in the stage of diffuse hepatitis or full-blown abscess, respond readily to specific treatment. In only a very small percentage does an amebic liver abscess require aspiration.

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An Evaluation of Automatic Exposure Control Equipment in Photofluorography[1]

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HISTORY OF AUTOMATIC TIMER DEVELOPMENT

LATE IN THE SUMMER of 1940, investigations were undertaken at the University of Chicago to develop equipment whereby radiographic exposure might be more effectively controlled than was possible by the customarily used anatomic measurement technic. Because the problems associated with exposure control in radiography are fundamentally similar to those in photography, the first work (4, 5) was directed toward the development of a roentgen-ray exposure meter comparable in principle and operation to the instruments commonly employed in photographic practice. This early research clearly demonstrated that, with care in design, an instrument whose performance is entirely satisfactory from the standpoint of consistency of results is not difficult to produce. At the same time, it appeared equally evident that such a device is not likely to be widely accepted because of certain inherent characteristics which limit its usefulness. For example, when an exposure meter is used to calculate the exposure factors of a particular anatomical structure under examination, it is necessary, for each film made, to make two exposures, one for taking an exposure meter reading and one for exposing the film. In addition to this objection, an exposure meter in general lacks the flexibility necessary for ready application to a wide range of radiographic technics. For these reasons, efforts were made to modify the exposure meter design so that the resulting equipment might be used to control radiographic exposure automatically, thereby not only eliminating the need for more than one exposure per film but also doing away entirely with the measurements and calculations normally carried out by the technician when making an exposure.

The product of this work was the automatic photoelectric timing mechanism (6), or phototimer, an instrument which was given its first clinical trial in November 1941, when it was installed on the spot-film fluoroscope in the University's Division of Roentgenology. This instrument, with only a few minor modifications, is still in operation today, some four years later. In this period it has performed an average of over 50 exposures per day, or a total of well over 50,000 exposures. Those who have used the fluoroscope regularly report a significant improvement in the quality and uniformity of the films. Furthermore, it is stated that no thought need be given the roentgen machine once it is adjusted at the beginning of the day's operations. The radiologist is thereby permitted to devote his entire attention to the patient and his clinical problems.

The photoelectric timing mechanism is fundamentally a rather simple device, consisting of a fluorescent screen, a multiplier phototube, and a condenser-thyratron-relay system. Since the instrument is so simple, it may reasonably be asked why its development has not been completed until recently. The answer is not difficult. The first investigations in automatic timer design were undertaken by Franke (2) in 1930. Although some progress was made, no practical results were achieved because the instrument that was developed employed an ionization chamber as the radiation detector. With the extremely weak

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radiation intensities encountered in radiographic practice, the output current of the ionization chamber was so small that the performance of the timer frequently became erratic. Furthermore, the spectral sensitivity of the chamber was not the same as that of the films then available. This has since been shown (5) to be incompatible with satisfactory timer performance.

No change in the status of automatic timing in radiography occurred until the development in 1939, by Zworykin and Rajchman (9, 10) of the 9-stage multiplier phototube, a device which is extremely sensitive to minute light intensities. Normally this tube is relatively insensitive to roentgen radiation but when covered with a fluorescent screen its response becomes very great. Indeed, its sensitivity is such that, when activated by the radiation intensities characteristic of radiography, the current output is several thousand times greater than that of even large ionization chambers. Furthermore, by the proper choice of the fluorescent screen for use with the phototube, the spectral sensitivity of the tube may be made to coincide with films exposed with and without intensifying screens. Thus the multiplier phototube successfully overcomes the difficulties previously encountered in automatic timer design. The tube became commercially available in 1941, after which advances in automatic exposure control equipment occurred rapidly.

Early in 1942 it became evident that the automatic photoelectric timing mechanism had very real potentialities in the improvement and simplification of radiographic technic, and a contract for the further development of the device was soon established between the Office of Scientific Research and Development and the University of Chicago. The research that followed has progressed in three directions. The first concerned itself with the development of a simple exposure meter which might be used on existing general radiographic equipment. In view of what has been said regarding the general impracticability of exposure meters, one may justifiably question this activity. An exposure meter is, however, a valuable tool under certain circumstances, as in orthopedic and portable radiography, and accordingly its development was pursued. That this work was not ill-advised is amply demonstrated by the recent report of Bell and Heublein (1). Furthermore, the exposure meter has proved an extremely valuable laboratory instrument, by which our knowledge of radiographic physics is being rapidly increased (8).

The second phase of investigation was directed to the development of automatic timers applicable to general radiographic equipment. An initial report of this work has been published (3). An additional communication will be prepared shortly and, accordingly, further reference to this research is not given here.

The third problem undertaken was the development of an automatic timing mechanism for use on photofluorographic equipment. In many respects this problem was relatively simple. Under these circumstances the same fluorescent radiation which is used to expose the photofluorographic film may be used to activate the automatic timer, a condition insuring satisfactory timer performance through a wide range of radiographic conditions without the need of the compensating circuits required in photoelectric timing mechanisms used in general radiography (6).

The first automatic timer for photofluorography was completed in the spring of 1943 (7). A second unit was installed in August of the same year on a 35-mm. photofluorograph belonging to the U. S. Public Health Service in Washington, D. C. In the next six months, 19 other units were constructed for photofluorographs belonging to the Coast Guard and Public Health Service. Several timers were also assembled for the Army and Navy.

FIELD EXPERIENCE

In the twelve to eighteen months since the installation of these photofluoro-

graphic phototimers, sufficient time has elapsed to permit a reasonably accurate evaluation of their merits and shortcomings. One of the Public Health Service's timers has performed well over 100,000 exposures. Many others are not far behind.

The several medical officers who have been working with phototimer-equipped photofluorographs report a considerable improvement in the quality and uniformity of automatically exposed roentgenograms over films exposed in the usual manner. This improvement not only facilitates film interpretation but also promotes more rapid reading and reduces fatigue. It is also found that, whereas the usual photofluorograph requires two operating technicians, one to measure and position the subjects and one to adjust the roentgen machine's controls, only one technician is required when exposures are performed automatically.

So far there has been no report of phototube failure in any of the several phototimers. In fact, it appears that phototube life may be considered unlimited. Multiplier phototubes seem extremely stable when operated under the conditions encountered in phototimer practice. No detectable change in sensitivity has been recorded either during a day's operations or from time to time through the period of a year and more.

Since the construction of these first phototimers, a few circuit modifications have been made in order to correct several minor difficulties arising after field trial. These may be more readily appreciated by reference to Figure 1, a block diagram of the original photofluorographic timer circuit. As shown there, the instrument includes a multiplier phototube, a phototimer condenser, a cold cathode thyratron, a pair of power thyratrons, a contactor, a safety timer, indicator circuits, two power supply circuits, and an exposure switch. When the exposure switch is closed, the power thyratrons are activated, thereby operating the roentgen contactor, which in turn energizes the roentgen machine.

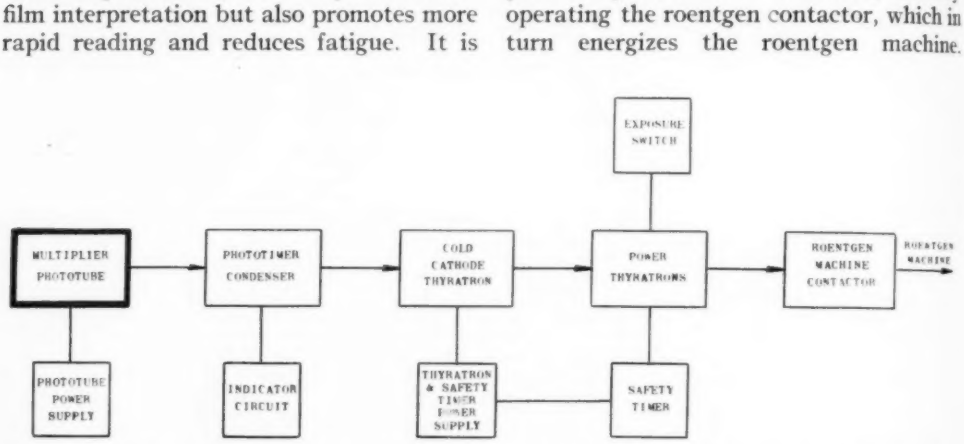

Fig. 1. Block diagram illustrating circuit arrangement of original automatic timer used in photofluorography.

Thereupon the multiplier phototube is activated by the fluorescent light falling on its sensitive surface and the resulting phototube current is collected by the phototimer condenser. When the charge appearing across the plates of the condenser reaches a certain level, the cold cathode thyratron is energized, thereby deactivating the power thyratrons and sequentially causing the opening of the roentgen contactor and the termination of the roentgen exposure. By adjusting the sensitivity of the multiplier phototube, the termination of exposure can be made to coincide with the instant at which the photofluorographic film has received a quantity of radiation which will insure optimal quality.

In the course of photofluorographic operation there may occur instances when

a subject under examination will require a greater exposure than that tolerated by the roentgen tube if optimal radiographic quality is to be achieved. For this reason, the electronic safety timer is included in the circuit to prevent exposures beyond the safe limit of the roentgen tube. The inclusion of the electronic indicator circuit in the phototimer was prompted by the desire to have a mechanism to signal faulty operation of the device.

Soon after these phototimers were placed in operation, the circuit was simplified by the replacement of the power thyratrons by a small rapid-action relay. In addition, the electron indicator circuit was removed because the infrequent occurrence of trouble made it seem superfluous.

Some of the phototimers after completing ten to fifteen thousand exposures developed an erratic performance which was traceable to irregular operation of the cold cathode thyratron. It was anticipated that trouble might arise in this part of the circuit because the power required to drive the thyratron was only slightly less than that delivered by the phototimer condenser. This difficulty might have been effectively overcome by the replacement of the cold cathode thyratron by a hot cathode type, a tube activated by extremely small amounts of power. The charge delivered by the phototube to the phototimer condenser is, however, of the wrong sign for operation of such a tube. The problem was solved by introducing a power amplifier tube between the phototimer condenser and the cold cathode thyratron.

In the original phototimer circuit, an exposure could be initiated by the exposure switch even though the power supply to the safety timer and thyratron circuit should fail. This situation was one to invite trouble, since, if power failure should occur, damage to the roentgen tube would almost inevitably be produced, because exposures would continue indefinitely until the exposure switch was released. This difficulty was corrected by placing the exposure switch directly in the thyratron power supply circuit so that an exposure could not be initiated in the absence of a properly functioning system.

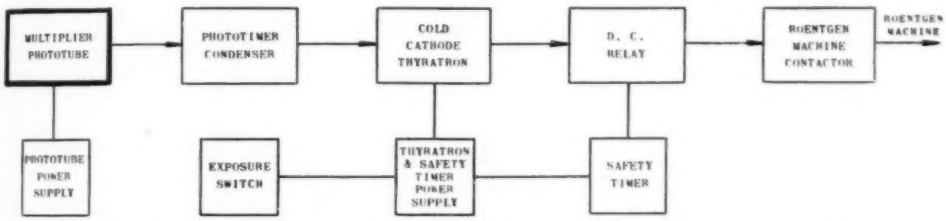

Fig. 2. Block diagram illustrating circuit arrangement of modified automatic timer now used in photofluorography.

A block diagram of the revised photofluorographic phototimer is shown in Figure 2. A schematic diagram showing the circuit in detail is presented in Figure 3. One such phototimer under test has performed over 250,000 exposures, with no evidence of failure. It therefore appears that this design may be expected to provide service equal to or in excess of that provided by the roentgen machine with which it operates.

COMMERCIAL PRODUCTION

During the time that these automatic timer developments have been in progress, several patents have been applied for under the recommendations of the Office of Scientific Research and Development. These patents, for the duration of the war, were assigned to the Government, which in turn granted free license to several manufacturers of roentgen-ray equipment to produce photo-timing ap-

paratus. Before long it is likely that the patent ownership will revert to the University of Chicago. In any case, free licensing will continue. This, taken in conjunction with the fact that little additional developmental work has been necessary on the part of the manufacturers, should make it possible to maintain the price of automatic timers at or near a level consistent with prices of conventional timers.

In recent months several manufacturers have begun commercial production of automatic phototimers for photofluorographic equipment. Three have followed the circuit design shown in Figure 3. Two others have done so with the exception that the power amplifier between the phototimer condenser and the cold cathode thyratron has been omitted. It is difficult to predict the performance of these instruments, since more sensitive phototubes are now being used than was the case when this circuit gave trouble earlier in our experience. Results of field trials are awaited with interest.

It is anticipated that within the next few years automatic timing equipment for general radiography will reach the same level of practicability as that now used in photofluorography. Very possibly, these developments will be sufficiently rapid to permit incorporation in post-war radiographic equipment when it first becomes available.

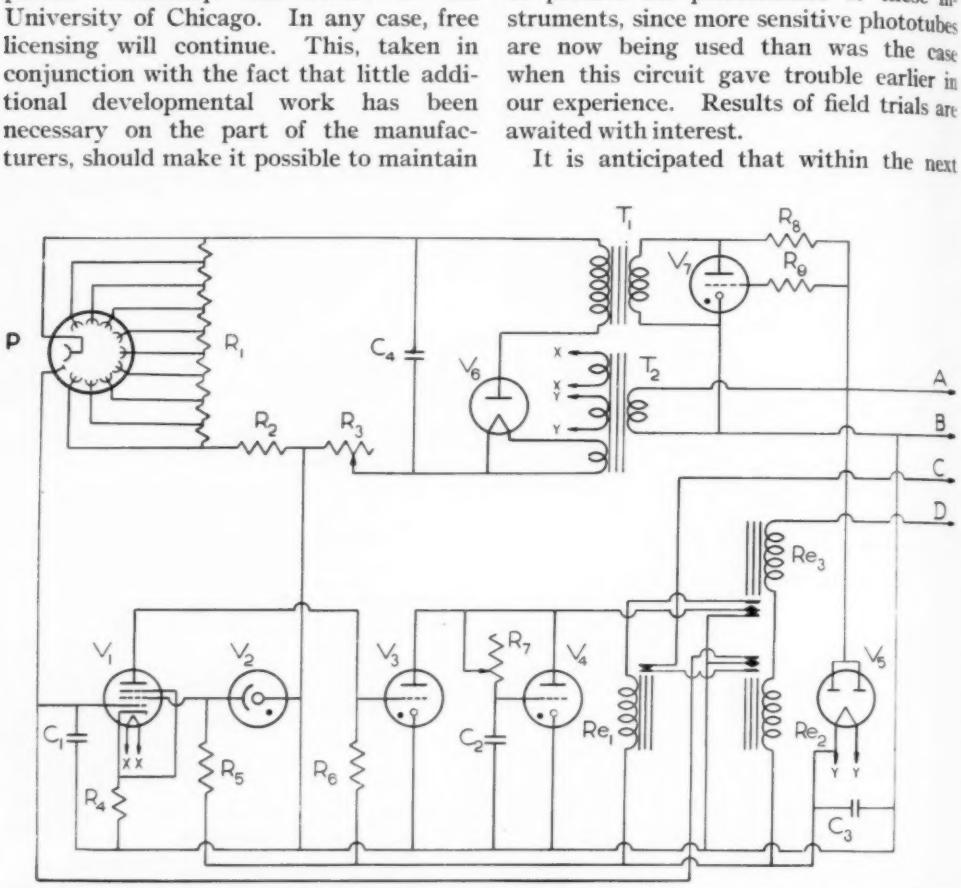

Fig. 3. Schematic diagram illustrating in detail the modified automatic timer circuit. P, 931-A multiplier phototube. V_1, 6J7 amplifier tube. V_2, OC3/VR105 voltage regulator. V_3, V_4, and V_7, 1C21 thyratrons. V_5, 5Y3-GT rectifier tube. V_6, 2X2/879 rectifier tube. R_1, Nine 0.1-meg. resistors. R_2, 0.1-meg. resistor. R_3, 1.0-meg. potentiometer. R_4, 1,000-ohm resistor. R_5, 0.25-meg. resistor. R_6, 4,000-ohm resistor. R_7, 5.0-meg. potentiometer. R_8, 750-ohm, 25-watt resistor. R_9, 75,000-ohm resistor. C_1 and C_2, 0.25-mfd. condensers. C_3, 16-mfd. condenser. C_4, 1.0-mfd. condenser. T_1, High-voltage transformer. T_2, Filament transformer. Re_1, Re_2, and Re_3, single-pole, double-throw d. c. relays. A and B are connected to a 110-volt power source. The roentgen contactor's field coil is connected between A and C and the exposure switch between B and D.

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An Unusual Case of Ewing's Sarcoma[1]

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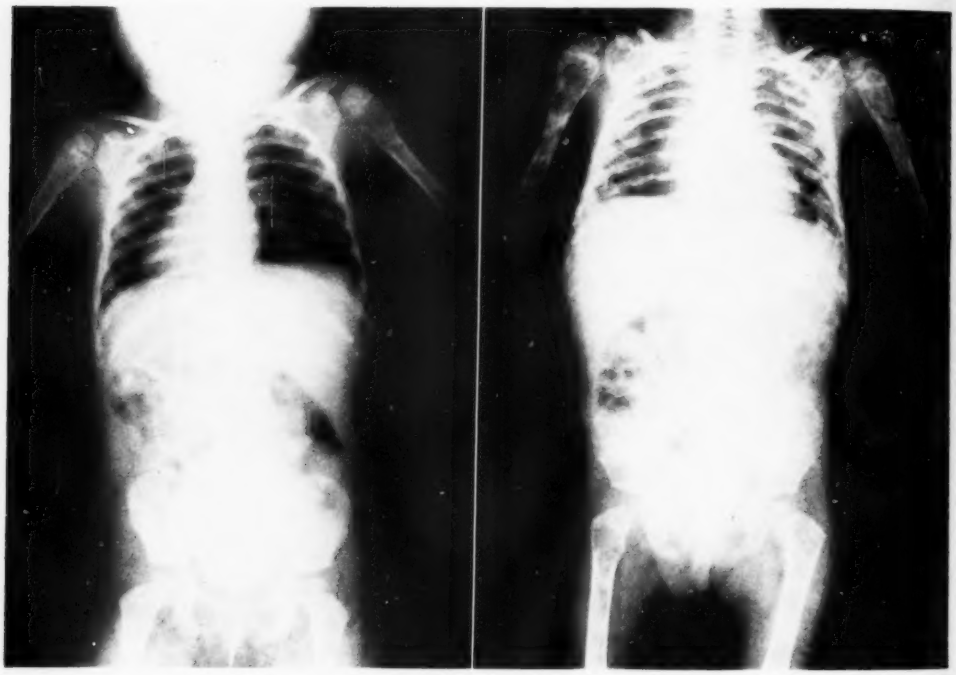
THE FOLLOWING case of so-called Ewing's tumor is presented not because the disease is rare enough to warrant a single case report in the usual instance, but because this case did show some outstanding findings.



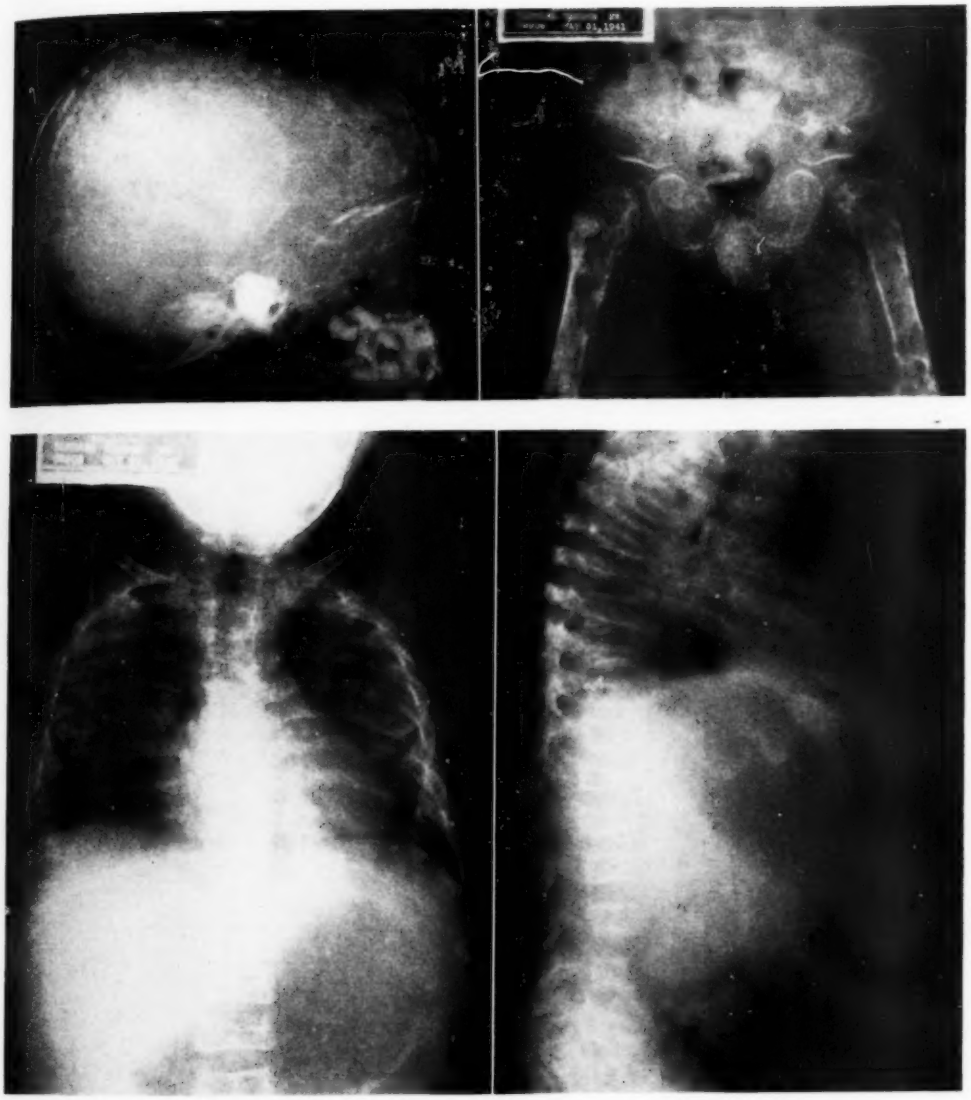
Figs. 1 and 2. Roentgenograms made in November 1940 (left) and March 1941 (right). The earlier film shows osteolytic lesions in the upper ends of both humeri. By March bone destruction had become generalized.

A white female infant, aged 2 years, was admitted to Jefferson Hospital on May 31, 1941, with the following history:

The child was perfectly normal until October 1940. It was then noticed that she cried whenever the right upper extremity was moved, apparently because of pain in the shoulder. The pain grew progressively worse and the upper portion of the right arm became swollen. A febrile course followed, and a diagnosis of acute osteomyelitis was made on the basis of the clinical and x-ray findings (Fig 1). On Nov. 16, surgical drainage had been undertaken at another institution. Recovery was slow and never complete. There were two attacks of "bronchopneumonia" during December, and not until January 1941 was the wound healed. From December 1940 until the time of admission to Jefferson Hospital, the patient had repeated episodes of vomiting, which would persist for about a week, and she continued to lose weight and strength. Bouts of fever recurred at frequent intervals. A roentgenogram in January 1941 was reported as showing normal bones in the entire skeleton, except for the shoulder. In March, x-ray studies revealed generalized bone destruction (Fig. 2).

In May 1941, the child was admitted to another hospital. She was noted to be markedly undernourished, with a peculiar yellow color. Crepitant râles were heard in the lung fields. The liver was

[1] From the Department of Radiology, Jefferson Hospital, Philadelphia 7, Penna. Accepted for publication in January 1945.



Figs. 3 and 4. Films made in May 1941, showing progressive skeletal involvement.

enlarged to two fingers below the costal cage. A soft movable mass was felt in the mid-abdomen, just below the umbilicus. There was a marked bilateral inguinal adenopathy.

Laboratory studies revealed a severe anemia, with hemoglobin 3 gm. The red cell count was 1,900,000; the white cell count was 31,000 with 76 per cent lymphocytes and 24 per cent polymorphonuclears. Some nucleated red cells were present. The Wassermann reaction was negative. The serum calcium was 12.5 mg. per cent, the serum phosphorus 3.8 mg. per cent, and the phosphatase 4.6 Bodansky units. The serum protein was elevated to 9.6 gm., per 100 c.c. with 4.0 gm. albumin, and 5.6 gm. globulin. No Bence-Jones protein was found in the blood or urine. X-ray studies of the skeleton showed extensive destruction of all the bones.

With three transfusions and daily liver extract parenterally, the hemoglobin rose to 7.0 gm. in eleven days, and the red cell count to 3,200,000. The white blood count dropped to 15,000. In spite of this, the patient continued steadily downhill, running a septic temperature, but apparently free from pain.

Fig. 5. Films made in May 1941, showing progressive skeletal involvement.

On May 31, 1941, the patient was transferred to the pediatric ward of Jefferson Hospital. The foregoing physical findings were confirmed. In addition, there was extensive nodulation in the scalp and over all the bony structures. Extensive cervical adenopathy was present. Peri-orbital edema had almost completely closed both eyes. Results of laboratory studies were approximately as previously reported, except that the serum phosphatase had now risen to 15.8 Bodansky units.

X-ray studies (Figs. 3–5) showed involvement of practically every bone in the body. There were no areas of bone production, but the entire skeleton was riddled with irregular areas of translucency of various sizes, resembling somewhat the cystic lesions of hyperparathyroidism, though that disease is rarely seen at this age. The cortices were expanded, thinned, and in many areas destroyed. There was no single area of healthy appearing bone in the skeleton. Even more remarkable was the extensive calcification of the arteries in both arms and thighs.

On June 12, under ether anesthesia, a biopsy specimen was removed from the left tibia (Fig. 6). The report by Dr. C. J. Bucher reads: "The section consists of tissue from a tumor of the bone. On section there is considerable necrosis of the bone. The tumor is very vascular and made up of a number of cells that have a scant cytoplasm and round, rather deep-staining nuclei. In most areas these cells are found about blood vessels and radiate out from the lumen of the vessel. In view of the history and histological character of the tissue, a diagnosis is made of Ewing's sarcoma."

The patient continued running a low-grade fever and died, apparently of respiratory failure, on June 12, 1941, twelve days after admission. Permission for autopsy could not be obtained.

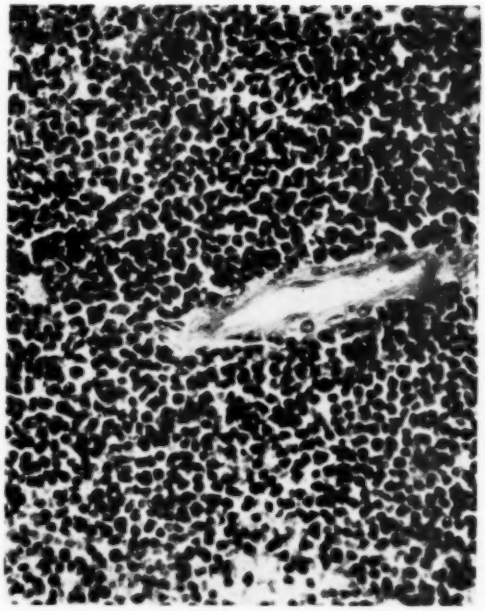


Fig. 6. Photomicrograph of biopsy specimen showing a type of cell usually associated with so-called Ewing's tumor, with typical perivascular arrangement.

DISCUSSION

In spite of the absence of an autopsy, there can be little doubt that this was a case of Ewing's sarcoma, apparently arising in the right humerus, with metastases to the abdominal, cervical, and inguinal nodes, and to every bone in the body. The history, resembling osteomyelitis with rapid spread after bone curettement, is almost diagnostic, even without histologic confirmation.

The unusually rapid and extensive bone involvement is indeed remarkable. Within two months the skeleton was completely riddled. With such widespread involvement, the roentgen picture could have been mistaken for hyperparathyroidism. It is, moreover, very unusual for Ewing's tumor to be found in a patient of this age. The youngest patient in a recently reported series of 26 cases (1) was four years of age and there were only three in the first decade of life. Even more remarkable is the calcification of the arterial trunks of the upper and lower extremities. Not only is such calcification in infants unheard of, but we have definite x-ray evidence that this vessel calcification occurred in less than two months (cf. Fig. 2 and Fig. 3). We can speculate that the rapid and overwhelming bone destruction produced a hypercalcemia with subsequent metastatic calcification of the vessel walls. This seems plausible since on two occasions the serum calcium was over 12 mg. per cent (12.5 and 13.7).

The absence of demonstrable pulmonary metastases is also rather unusual, in view of the other extensive involvement.

One other point of interest is the completely osteolytic nature of the primary lesion in the humerus. This bears out the findings in another series studied by one of us (P.C.S.) that this is more common than

is the finding of various forms of bone production (1).

SUMMARY

1. An unusual case of Ewing's sarcoma in a two-year-old girl is described.

2. Within two months, metastases involved every bone in the skeleton, giving rise to a bizarre roentgen picture.

3. Extensive calcification in the arteries of the upper and lower extremities is an additional unusual feature of this case.

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Roentgenologic Visualization of the Fractured Temporal Styloid Process[1]

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FRACTURE OF THE temporal styloid process may occur in diffuse head and neck injuries or in the operative removal of the palatine tonsils. In the former event, it is but a single incident in a group of more important injuries. These may include fractures of the skull and of the cervical spine, atlanto-axial subluxation, sprain of the neck, loosening or tearing of the meniscus of the temporomandibular joint, and fractures or other injuries elsewhere. Fracture of the styloid process may be suspected when the patient has difficulty in swallowing or experiences pain between the mastoid process and mandibular condyle.

The styloid process of the temporal bone develops from two centers of ossification and may consequently be bipartite or multipartite. Its roentgenologic demonstration is often difficult, usually only the lower part being seen. It may be adequately shown in the open-mouth view of the edentulous patient (Fig. 1). Pancoast, Pendergrass, and Schaeffer, in their book on roentgen examination of the head and neck, stated that the bone is easily seen in posterior-anterior roentgenograms, especially those used for the examination of the maxillary sinuses. A lateral view of the nasopharynx and upper neck also shows it well. If the head is rotated a little, the two styloids are dissociated from each other.

We became interested in the roentgenologic visualization of the styloid process in connection with the following case, and a radiographic technic to show the full length of the bone was devised.

CASE I: J. V., male, 30 years old, was struck on the left side of his head by the swinging doors of a speeding truck on March 19, 1940. The blow was a glancing one to the left frontal region, the skin being lacerated at that point. The patient was thrown to the ground so that he struck the right side of his head. He was unconscious for several hours and remained in a hospital for one day. Two neurologists who examined him because of constant dizziness and headaches agreed that he had sustained a cerebral concussion (with probable encephalopathy and right facial paresis). No roentgenographic signs of fracture of the skull were found. Some teeth and a denture were broken.

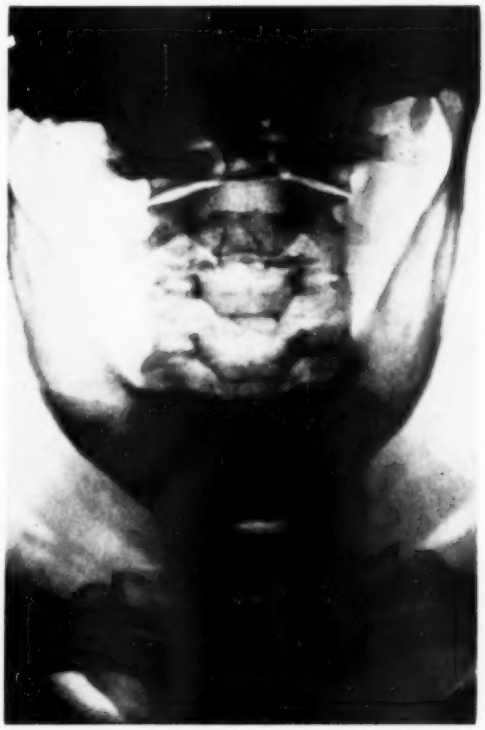

Fig. 1. The edentulous mouth allows fairly easy visualization of the styloid process in the routine open-mouth view.

Severe pain occurred in the region of the right mastoid process when the jaw was shifted to the left, increasing in intensity when the same maneuver was done with the mouth open. Because of this, roentgenograms were taken of the jaw by the patient's dentist, Dr. H. H. Kaplan, Jr., and a fracture of the styloid process was revealed.

When the case first came to our attention April

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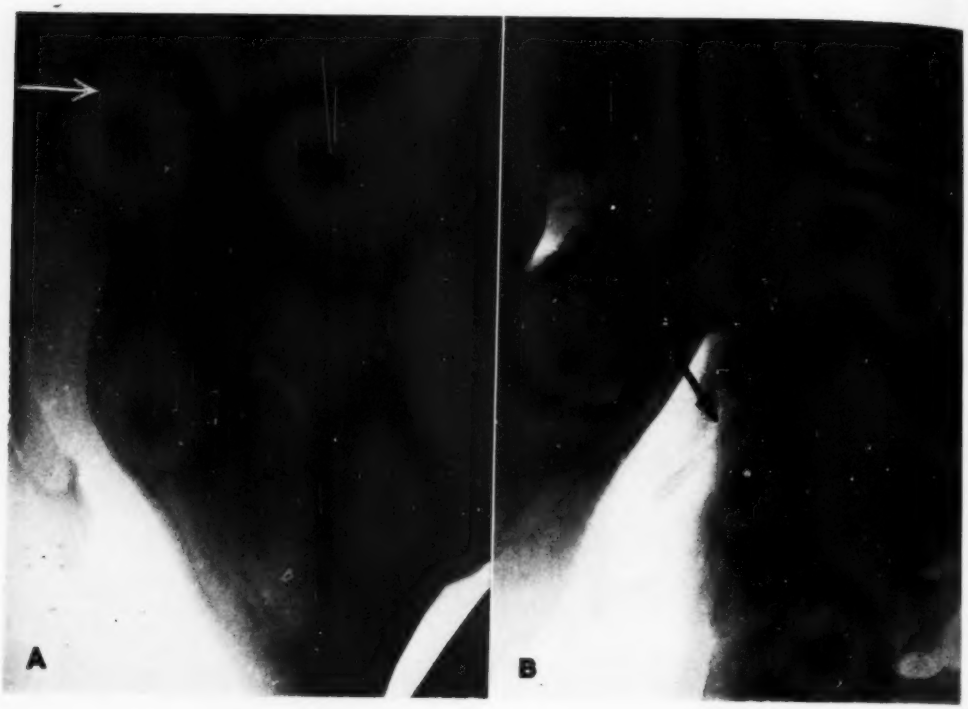

Fig. 2. Case I. A. Roentgenogram of the right temporal styloid process showing its fracture (taken by Dr. H. H. Kaplan, Jr., March 23, 1940). B. Roentgenogram taken by the authors' technic. A little callus is present. (April 15, 1940.) C. Open-mouth roentgenogram of the atlas and axis, showing a slight shift of the atlas to the right, as measured by the distance from odontoid to each lateral mass of the atlas.

15, 1940, pain still persisted. It had become dull but constant, with occipital radiation. With the mouth open 1/2 inch, and with no deviation of the jaw, pain was experienced in the region of the fracture. The patient heard a cracking sound in the right temporomandibular joint when he opened his mouth or when he ate hard food. He remembered that some ten days after the accident the right jaw became dislocated for about a minute, with rapid replacement of the condyle into its socket on manipulation.

Opening of the mouth was limited to about 3/4 inch. When it was open about 1/2 inch, the condyle of the right jaw was prominent and tender. Motion of the right condyle was greater than that of the left and began sooner. The patient could move the jaw from side to side, but this caused an increase of pain in the very tender area between the mastoid posteriorly and the upper posterior border of the vertical ramus of the mandible anteriorly. Motions

of the neck were good, but left lateral bending produced pain in the region of the fracture. (It should be noted that the patient had sustained a possible fracture of the middle fossa of the skull ten years before, but that he had been free of symptoms for at least six years before the recent accident.)

The roentgenogram made on March 23 by Dr. Kaplan (Fig. 2, A) showed the fracture of the right temporal styloid process about 1.5 cm. proximal to its tip. A roentgenogram (Fig. 2, B) made April 15 by a technic developed from that of Dr. Kaplan (described below) showed some healing of the fracture. The left temporal styloid process was normal. The cervical curve was much reduced, and an open-mouth view (Fig. 2, C) showed a shift of the atlas to the right with increase in the right intervertebral space between atlas and axis. In the open-mouth position the right mandibular condyle showed normal excursion to beneath the articular eminence, but the left condyle remained in its socket.

Fig. 3. Case II. The arrow indicates the site of fracture of the styloid process. This fracture was one of many injuries.

The principal obstacles to adequate roentgen visualization of the styloid process are overlapping of the bodies of the upper cervical vertebrae posteriorly and the mandible anteriorly. It is easy to demonstrate the distal end of the styloid, but it was necessary in the case reported above to show the entire bone. For visualization of the right styloid process, the patient was seated in the right oblique position (about 15 degrees) with head bent to the right at an angle of about 10 degrees. The head was also extended about 10 degrees to bring the mandible out of the line of the styloid. The cassette was placed upon the patient's right shoulder and held firmly against the side of the neck and head by

his right hand. The x-ray tube was set about 20 to 30 cm. to the left of the patient, approximately 10 cm. anterior to and at the level of the patient's knees. The tube was then tilted upward about 45 degrees and backward about 30 degrees, so that the central ray entered the left side of the neck in an oblique and upward direction 3 to 4 cm. below the angle of the mandible.

A second case examined roentgenographically but not treated by us may be briefly summarized.

CASE II: A man of about 60 years sustained a fracture of the left styloid process in an automobile accident and thereafter had difficulty in swallowing. The styloid fracture was a minor injury among a multiplicity of others, which included unconsciousness, multiple fractures of the ribs and transverse process of the lumbar vertebrae, compression fracture of the second and third lumbar vertebrae with narrowing of the intervertebral disk, and left hemorrhagic pleurisy. The styloid processes were easily seen. The fracture site is designated by an arrow in Figure 3. (The possibility of a bipartite styloid process is to be considered in this case.)

SUMMARY

Fracture of the temporal styloid process may occur as one of many injuries after severe head and neck trauma. A method of roentgenologic visualization which may occasionally be useful is described.

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Lipiodol Intravasation During Uterosalpingography with Pulmonary Complications[1]

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UTEROSALPINGOGRAPHY has become an important diagnostic method in the gynecologist's armamentarium, particularly in problems of sterility. With proper technic and a reasonably careful selection of cases, it has proved to be a safe and useful procedure. Occasionally, however, it has been followed by complications due to accidents in the course of the injection. One of these is intravasation of the iodized oil into the venous system of the uterus.

This accident is apparently not very rare. Robins and Shapira (1, 2) found that it occurred 18 times in their first series of 1,000 uterograms. Rohan Williams (3) saw 6 cases in one year. The occurrence is probably frequently missed, especially if the amount of oil intravasated is small, when it may merge with the shadow of the uterus and tubes, particularly if the latter are enlarged. In the majority of instances there are no ill effects. Robins and Shapira noted a slight leukocytosis as the only result. On the other hand, rare cases, such as those of Hemmeler (4) and Lin and Tsou (5), of pulmonary and cerebral embolism and pulmonary infarction serve to warn us that this accident must be considered as at least potentially serious.

In an attempt to study the mechanism of lipiodol embolism in the lungs, Sicard and Forestier (6), after some animal experimentation, injected the oil deliberately into human beings. They introduced 2 to 4 c.c. into the cubital vein and found that the lipiodol reached the lungs in five or six seconds, remained there for six to eight minutes, and then suddenly disappeared. The only effect on the patient was a slight cough. Walther (7) injected the iodized oil into the ear vein in rabbits and found that practically all of it became arrested within the smaller veins and capillaries of the lungs. There, he found, it undergoes two processes. The major portion of the emboli is broken up into its two main constituents, iodine and fat, by the blood lipases and the lipolytic action of lung tissue. Most of the iodine is excreted by the kidneys during the first eight days as potassium iodide. The fat is saponified and carried off by the circulation. Some of the lipiodol, however, is engulfed by the phagocytes from the vascular endothelium and adventitial cells and by the alveolar epithelium. Walther suggests that in accidental intravasation during uterosalpingography inflammatory areas may develop in the neighborhood of the fat droplets due to bacteria carried along by the lipiodol from the cervix and uterus.

Various factors have been mentioned as likely to contribute to the occurrence of this accident. One of these is direct trauma to the endometrium by the uterine cannula. This may occur in the presence of submucous fibroids or in malposition of the uterus, such as retroversion or lateral angulation. If, in ignorance of these conditions, the cannula is introduced in the ordinary way, it may happen that the point comes in direct contact with the endometrium, and any slight abrasion will favor intravasation. In the fatal case of Lin and Tsou, quoted by Walther, intravasation was found at autopsy to be due to rupture, by the point of the cannula, of an enlarged vein spread over the top of a submucous fibroid. A case of surgical emphysema following air insufflation for a Rubin test is known to us, although not from our personal experience. It is reason-

[1] From the Departments of Radiology and Obstetrics and Gynecology, Mount Sinai Hospital of Toronto. Accepted for publication in January 1945.

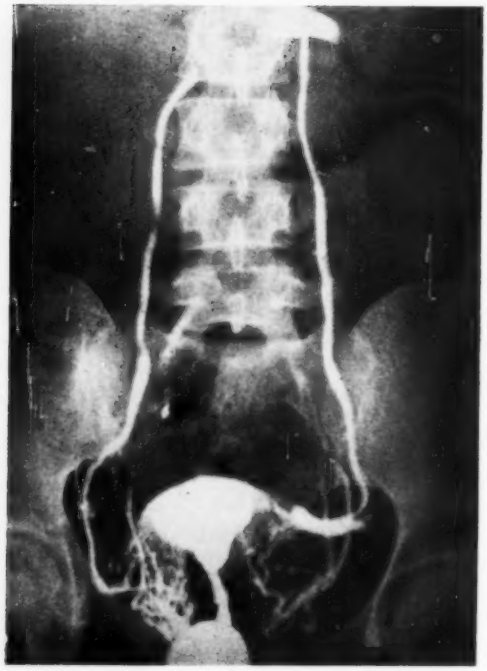


Fig. 1. Lipiodol intravasation into the uterine venous plexus and the ovarian veins. The latter resemble ureters, being filled in their entirety, on the right side to the vena cava and on the left up to and including the renal vein.

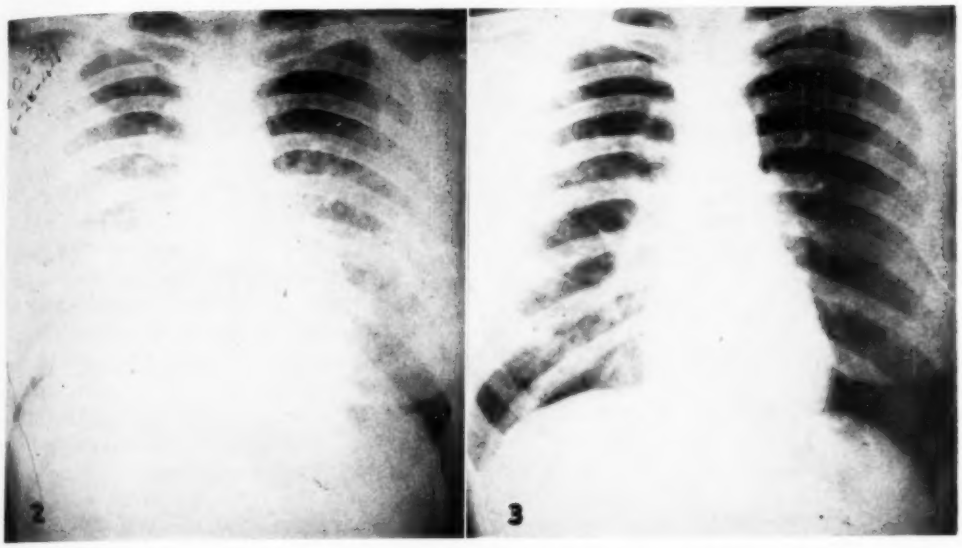
able to assume that the air, in this case, must have entered the tissues at the site of some trauma in the endometrium caused by the point of the uterine cannula. We mention these cases because we are aware that some gynecologists do not believe that in actual practice the endometrium can be thus damaged.

Many writers believe that intravasation may be caused by excessive pressure during the course of the injection and for this reason recommend that it be done under manometric control. In a poll among gynecologists, however, we have found no unanimity as to when pressure is to be considered excessive. Jarcho (8) recommends 150 mm. mercury, stating that tubes that do not open at this pressure must be considered as permanently closed. Most gynecologists whom we have questioned use a pressure of 180 to 200. Some, however, have used higher pressures, up to 300, routinely, without deleterious results. Some writers doubt whether in actual practice excessive pressure will, of itself, cause intravasation. Williams reported 3 cases in which the injection had been done under manometric control, presumably at a safe pressure. Moreover, Witwer and his co-workers (9) report a case of extensive intravasation in which the pressure was kept low under manometric control and every precaution was taken to avoid injury to the endometrium. Their subsequent experiments with extirpated uteri showed that occasionally intravasation could be obtained with injection under low pressure. These writers concluded that in some cases neither trauma nor excessive pressure is the potent cause of intravasation but that a third factor must be added, namely "an increased permeability of the 'receiving sinuses' such as is observed in idiopathic uterine bleedings."

Recent operation on the uterus, in particular a dilatation and curettage, has been considered as likely to favor intravasation. This is as we would expect, since a curettement would remove the protective layer of the mucosa and bring to the surface the underlying venous sinuses. Williams reported 2 cases of intravasation in which the injection had been done within seven days after a dilatation and curettage.

By analogy, one would expect that injection too soon after a menstrual period might also be predisposed to result in intravasation. The possibility must be considered as not unlikely that lipiodol injected under pressure before the endometrial lining has been restored, which is probably not before six to eight days after the end of menstruation, may enter the endometrial vessels. In 4 of Williams' cases of intravasation the injection had been done from two to four days after menstruation. In Lin's case, according to Walther, the injection had been done at a pressure of over 200, shortly after a period and under general anesthesia.

The amount of lipiodol used and the method of its introduction vary with different operators. Some writers advo-



Figs. 2 and 3. Figure 2 is a chest roentgenogram made nine days after uterosalpingography, showing a dense patchy opacity involving the lower two-thirds of both lungs. Figure 3, a roentgenogram made a month later, shows only an increased prominence of the peribronchial markings on the right side.

cate a fractional method of injection, using a preliminary amount of 1.5 to 2.0 c.c. Others give as high as 20 c.c. at an injection. Most gynecologists, we find, use 4 to 8 c.c. at one injection. The amount of lipiodol used probably has no bearing as a cause of intravasation. Where, however, intravasation does occur, the larger the amount injected the more likelihood there is of symptoms being produced.

CASE REPORT

Mrs. M. G., age 28, gave a history of instrumental abortion at the age of seventeen. In January 1941 she had a ruptured ectopic pregnancy of six weeks gestation, at which time the left tube was removed. The right tube appeared normal. In December 1941 Rubin tests done on two occasions were negative. The patient's general health was good except for frequent colds. Her last menstrual period previous to uterosalpingography was June 9–13, 1944. Lipiodol injection was done on June 19, in the morning. The usual technic was employed except that the amount injected, 15 c.c., was more than we ordinarily use. The ordinary pressure was used but without manometric control. No unusual difficulty was encountered.

On examining the film, we were surprised to find the bizarre picture shown in Figure 1. Not only was the cavity of the uterus filled, but its outer surface was visualized by contrast material within the venous plexus within and surrounding its walls. More spectacular, however, was the filling of the uterine and ovarian veins and their tributaries on both sides. The ovarian veins resembled ureters and were filled in their entirety, on the right side to the vena cava and on the left up to and including the renal vein. A film taken ten minutes later showed a decrease in the amount of lipiodol in all the veins.

The patient complained of more than the usual amount of abdominal discomfort and said she felt shaky and "jittery" but, after lying down for an hour, was able to go home. That afternoon a dry cough developed and in the evening the temperature rose to 102°. Physical examination showed only a few rhonchi throughout the chest. A film of the pelvis taken on the following day showed a lacy pattern of contrast material in the region of the uterus, suggesting the presence of some residual lipiodol within the smaller uterine veins. The right tube was filled. On the left side there was pooling either within a large varicosity of the ovarian vein or possibly in an extravasation within the broad ligament.

On the second day after the injection the patient felt sick. Her cough had increased in severity and she brought up bloody sputum Her temperature was 102.5°. On the third day the temperature had dropped to 101°. A film of the pelvis resembled that taken on the day after the injection. On the fourth day the temperature was normal and remained so thereafter. The cough persisted, however, and on June 28, nine days after uterosalpingography, a chest roentgenogram was obtained (Fig. 2). This showed a dense, patchy opacity involving both lungs below the 2d ribs. There were areas of con-

glomeration, especially on the right side, where the appearance was denser, but all of the lower two-thirds of the lungs appeared opacified to some extent The density was greater than that seen in the usual atypical pneumonia and it had a patternless, somewhat smeary appearance The clinical condition of the patient was surprisingly good, out of all proportion to the appearance of the chest film. One month later the chest was re-examined and on this occasion, aside from a slightly increased prominence of the peribronchial markings on the right side, the lungs were clear (Fig. 3).

The nature of the chest findings in this case is somewhat problematical. In the light of the clinical history we feel that it is reasonable to assume that the pathological changes were the result of lipiodol embolism. The nature of these lung changes is suggested by the experimental studies of Walther. From these we would deduce that the unusual pulmonary densities in our case may be attributable to various degrees of all of three factors, namely, residual phagocytosed lipiodol, perifocal pneumonitis about the emboli, and actual infarction.

It is felt that intravasation is not always avoidable even with the best technic, since its occurrence may depend upon intrauterine conditions beyond our knowledge. Certain measures designed to prevent it or limit its extent are, however, within our control and in this regard we feel that the following recommendations are appropriate.

(1) Injection for uterosalpingography should not be done earlier than six to eight days or later than ten days after completion of menstruation. The optimum period would seem to be eight to ten days after the menstrual period. It should not be performed in less than ten days after any operation on the uterus, in order to allow for complete healing.

(2) The position of the uterus should be determined by the use of a sound. When the cannula is inserted, it should be held, if necessary, at an angle that is calculated to make it parallel to the cervical canal, so that the tip of the cannula is not likely to be in contact with the endometrium. Williams recommends that the injection be done under fluoroscopic control both for ascertaining the position of the uterus and for early recognition of any intravasation. All roughness should, of course, be avoided. To this end, anesthesia is not only unnecessary but undesirable.

(3) In the presence of a normal endometrium we do not feel that the pressure likely to be needed will, by itself, cause intravasation. However, because of the possibility of a uterine mucosa of increased permeability, it is best to keep the pressure as low as is commensurate with proper filling of the uterus. A top pressure of 180 to 200 mm. mercury is safe and satisfactory in practically all cases, and we see no advantage in exceeding it. A manometer should be used for control of pressure and for purposes of record.

(4) The amount of lipiodol injected should be no more than is necessary to fill the uterus and tubes, with a slight spill. A satisfactory plan is to inject 4 to 6 c.c. and maintain pressure while the film is taken and developed. If more lipiodol is required, it can be injected subsequently. The preliminary injection of a small amount is important in that, if intravasation has occurred, it can be detected before a large amount of oil has entered the veins and hence is not likely to produce symptoms.

SUMMARY

Attention is drawn to lipiodol intravasation as a possible accident during uterosalpingography, and an illustrative case is reported. The factors involved in its production and the nature of associated pulmonary complications are discussed. Some suggestions are made as to how to avoid this accident.

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Bone Rarefaction After Skull Injuries[1]

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Chicago, Ill.

WE HAVE observed, several times in the past, areas of bone resorption in the skull following an injury, though in no instance was a connection between the trauma and the post-traumatic change unequivocably established. Recently, there have come to our attention, however, similar changes years after injury but with definite proof of the occurrence and nature of the antecedent trauma.

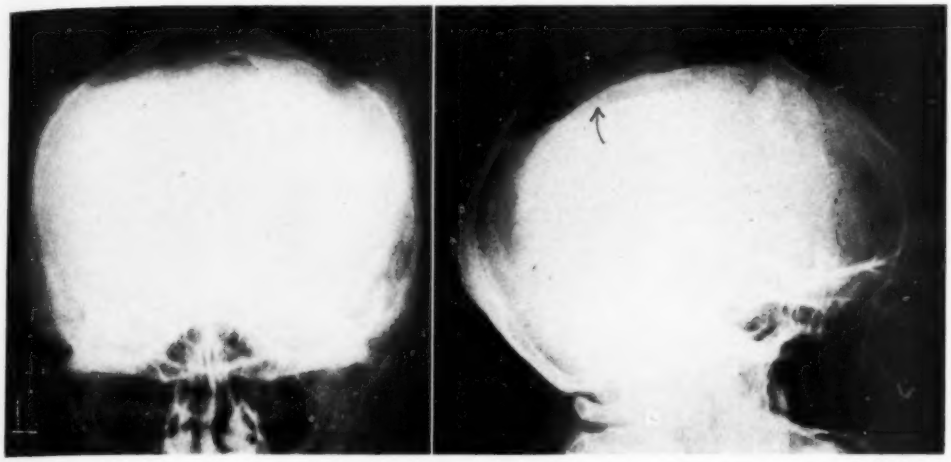
The object of this paper is to present three cases and to point out that one or more years after a skull injury—not necessarily a fracture—bone absorption and bone deposition may occur in the injured area, more particularly in younger persons. While we can present only a few cases, we believe that larger institutions will be able to throw the support of their rich material into the discussion of the problem here presented. Sir Thomas Lewis once said that it took him eleven years to find his first case of coarctation of the aorta, but only one year to find the next eleven cases.

Skull fractures and skull injuries are in many respects different from fractures and injuries of other bones of the body. They are set apart by the entirely different blood supply on the surface of the skull, the absence of an active circulation within the cranial bones, a unique bone structure which permits a fracture of the inner table without involvement of the outer table, and the slow healing of fracture lines with occasional replacement by fibrous tissue. It is of importance that the diploic veins are in connection with the veins of the galea as well as of the dura. The inner table, having its own blood supply, might well escape an absorptive process involving the outer table and the diploic wall.

The appearance of bone rarefaction a long time after injury, frequently accompanied by clinical symptoms and disability, is a familiar occurrence in other parts of the body, though it is little known in the bones of the skull. The considerable literature which has accumulated on the subject is accurately reviewed and discussed by E. S. King in his book on "Localized Rarefying Conditions of Bone." King classifies these rarefying conditions in two groups, diffuse and localized, but makes no mention of their occurrence in the skull. Many handbooks on skull fractures similarly fail to give any account of post-traumatic rarefaction of the cranial bones comparable to Kümmell's disease of the spine and the creeping substitution and aseptic necrosis observed in the carpus, tarsus, femur, humerus, and scaphoid, all having trauma as a common denominator.

Pancoast and Pendergrass, however, state that as a result of injury and presumably interference with the blood supply, an aseptic necrosis involving the diploe and the outer table may produce destruction of these portions of the calvaria. These necrotic areas may be either circumscribed or irregular, according to the type of injury. Translucent areas are frequently due to fibrotic tissue replacing the necrotic bone, or to a cystic development, as further sequelae of the traumatic lesion. These are sometimes diagnosed as "fibrosing osteitis." According to Pancoast and Pendergrass, the original fracture may at first be invisible, a "closed fracture," the fracture line appearing at a subsequent reexamination. In one of their cases of this type the pathological diagnosis following operation was "fibrosing osteitis of undetermined origin." Our Case II is another example of fibrotic substitution at the site

[1] From the Department of Roentgenology, Mount Sinai Hospital, Chicago, Ill. Accepted for publication in January 1945.



Figs. 1 and 2. Case I. Figure 1, the anteroposterior view, shows post-traumatic rarefaction of the tops of the parietal bones, with sclerotic ridge formation along the vertical part of the bones. Figure 2, the lateral view, shows the sharp demarcation toward the frontal and occipital bones. Over the top of the skull, only the inner table is preserved. The sagittal suture has not been spared.

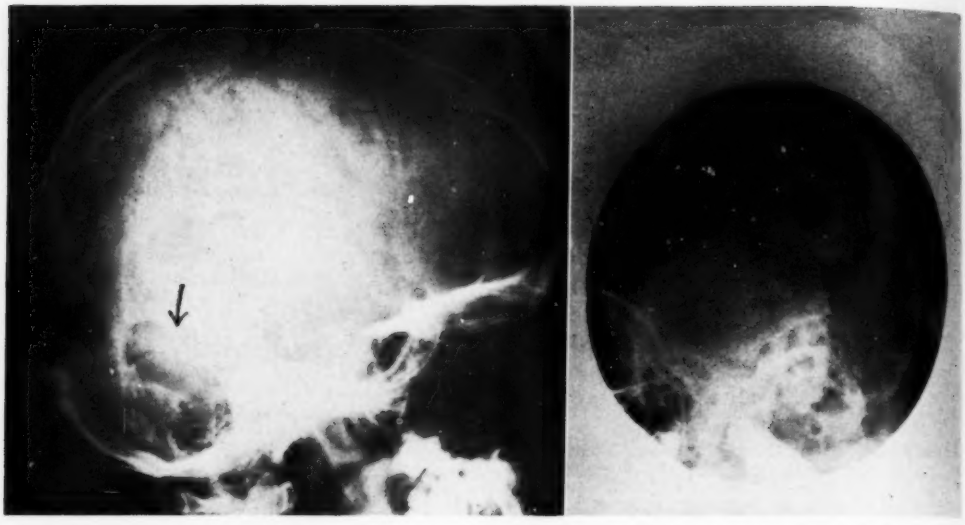
of a previous skull fracture, which may be designated as "fibrosing osteitis." Case I represents another stage of post-traumatic change, a sclerotic type of osteitis.

Thinning and thickening of skull bones are not pathologically opposed processes; bone deposition and bone absorption are active cellular processes, both depending on adequate blood supply and cellular activation. In inflammatory conditions, as well as in Paget's disease and other metabolic disturbances, we have a simultaneous appearance of osteoclastic activity and new bone formation. The first step in bone necrosis as it occurs post-traumatically in the skull, as elsewhere, is an interference with the blood supply. So long as it remains "architecturally intact," the damaged bone area will not show any abnormal x-ray signs, but when fibroblasts invade the necrotic area and it becomes revascularized, osteoclastic as well as osteoblastic cells appear and we have the picture either of an area of fibrous substitution, "fibrosing osteitis," or new bone formation, "sclerosing osteitis." The same circulatory conditions may lead to either.

A post-traumatic, pathological area in the skull may appear either as a translucent or as a sclerotic area, and it is not necessarily a depressed or linear fracture which leads to such a change. Finding such a circumscribed area in the x-ray picture, we should at least ask whether there is a history of trauma and take the possibility into differential diagnostic consideration. The medicolegal aspects are far reaching.

CASE REPORTS

CASE I: A woman 53 years of age, with no complaints of any kind, was told by her hairdresser that she had abnormal elevations and depressions of the skull and was urged to seek medical advice. A depression was palpable in either parietal bone, with irregular elevations and a marked prominence along the ridges. The examining physician (Dr. I. A. Rabins) ordered an x-ray study of the skull, and the unusual picture presented in Figures 1 and 2 was obtained. In the anteroposterior view (Fig. 1) the tops of the parietal bones are seen to be markedly thinned; in this area only the inner table remains, preserving the normal convexity of the skull. Had not the inner table been preserved, the skull would appear quadrangular rather than ovoid. The rarefying process extends over the sagittal suture but does not reach as far down as the squamous suture. It ends rather abruptly where the convexity of the top of the skull passes over into the vertical lateral wall. The lateral view (Fig. 2) shows a large segment of the top of the parietal bone to be rarefied, with a rather sharp demarcation against the frontal bone, the occipital bone, and the vertical portions of the parietals. These latter show a considerable sclerotic thickening.



Figs. 3 and 4. Case II. Figure 3 shows the large defect, with scalloped edges, in and above the left mastoid. Figure 4 is a close-up view of the defect after radiation therapy. No response to irradiation is evident.

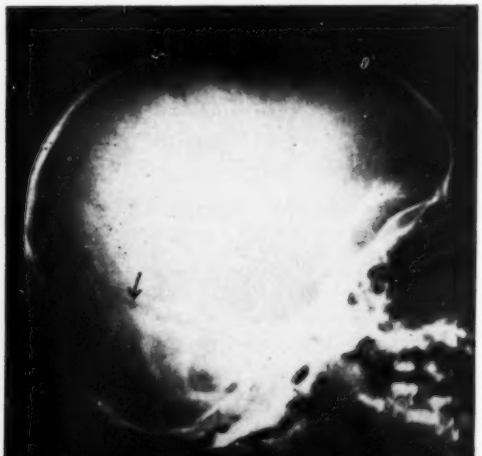


Fig. 5. Case II. Film made four years before those reproduced above, following an accident, showing fracture line in the area of the defect.

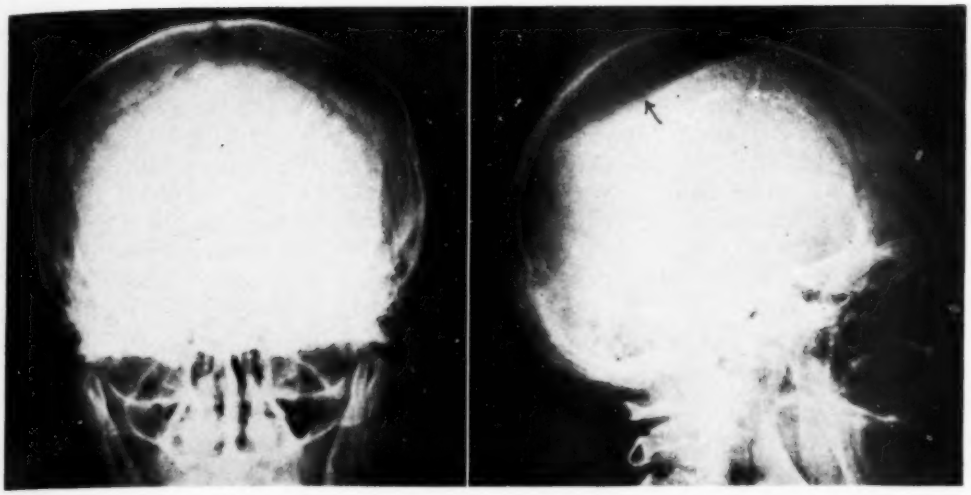
This picture, calling to mind a derby hat crushed as its wearer passed through a low doorway, suggested a traumatizing force acting upon the skull from above. On questioning, the patient recalled an unusual accident. On a shopping tour as a bride, she was hit on the head with considerable force by a descending elevator of the old "pater noster" type. She was dazed and unconscious, but no skull fracture was diagnosed and the accident was forgotten. There were no pathological findings on clinical examination; blood calcium and phosphatase were normal. Encephalography was suggested but was refused.

CASE II: The patient was a child of 12 years. The mother had noticed a softened area behind the left ear, which gave a slight "cracking" sound on pressure. The examining physician confirmed this observation and found a slight sensitivity to pressure in the mastoid area. X-ray examination revealed a large, well defined defect behind the left ear above the mastoid, back of the sigmoidal sinus. The defect extended apparently through the entire thickness of the skull, showing scalloped edges (Figs. 3 and 4). Palpation disclosed a thin plate of bone which yielded to pressure and, like the membrane of a stethoscope, gave forth a "cracking" sound.

Here again there were no clinical findings of significance. The child had no fever, was in excellent condition, and behaved normally.

A multitude of diagnoses, especially Schüller-Christian disease, came to mind, but inquiry revealed a history of a skull injury four years previously. A film taken at that time showed clearly a fracture line going through the area (Fig. 5) of the defect. This line was no longer visible. On this basis the conclusion was reached that we were dealing with a post-traumatic rarefaction, and aspiration biopsy was suggested.

The neurologist (Dr. Eric Oldberg) was convinced that this was quite definitely a post-traumatic rarefaction and added, in his report, that he had previously seen such changes following trauma, especially in children. He suggested x-ray therapy.



Figs. 6 and 7. Case III. Figure 6 shows grooved thinning of both parietal bones believed to be of developmental origin, though this patient had suffered severe injury in an accident fifteen years previously. Figure 7, the lateral view, shows the segmental rarefaction of the parietal bones.

CASE III: This case is more contestable than Cases I and II, and is added here as illustrative of the differential diagnostic difficulties. The patient was a white woman 56 years old, perfectly well, with no headaches or other symptoms referable to the skull. The history is similar to that in Case I, the elevations and depressions of the skull having been discovered by a daughter who was dressing the patient's hair. A physician (Dr. Dolnik) was consulted and x-ray examination was ordered. The film (Fig. 6) shows a type of grooved thinning of the parietal bones with bone of normal thickness and structure around the sagittal suture. The lateral view (Figs. 7 and 8) show a segmental rarefaction of the parietal bone with a demarcation zone of increased diameter. The roentgenologic diagnosis was "grooved type of parietal thinness of developmental origin, as described by Camp and Nash."

The patient, however, called our attention to an accident sustained fifteen years earlier, when her car overturned and she was thrown into a ditch. She was unconscious, but no x-ray picture of the skull was taken; she had, however, a fractured clavicle and many bruises. In contrast to Case I, this case demonstrates, at least roentgenologically, what is in our opinion the typical picture of parietal thinness sparing the sagittal suture, which was involved in Case I. At least, the grooved type of parietal thinness is known never to reach the sagittal suture. Furthermore, the pronounced sclerotic reaction seen in Case I is absent here.

Taking into account that localized thickening of the skull, especially of the parietal bones, is frequently due to subperiosteal

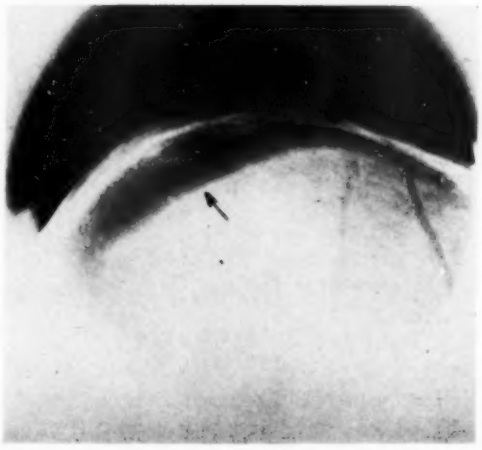


Fig. 8. Case III. Close contact view of marginal area.

hemorrhage, we are tempted to ask whether some cases of parietal thinning are not also due to trauma. Parietal thinning has been found not only in older persons, but also in children, at least one instance being reported in a child of four. Such trauma might be in the form of a birth injury, for example, disturbing the normal balance between bone absorption and bone restitution which goes on throughout life. Biparietal blood extravasation, as seen in

biparietal cephalhematoma as a result of birth injury, shows a typical retraction along the sagittal suture due to the close contact between the pericranium and the bone along this suture which persists throughout the first few years of life. In adults the pericranium and galea are easily elevated by hemorrhage (Fig. 9).

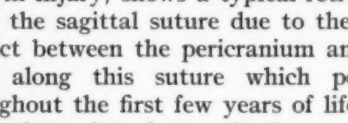


Fig. 9. Sketch showing cephalhematoma with retraction along the sagittal suture, due to close pericranial attachment to suture and dura mater.

In our opinion the condition called parietal thinness is not a form of senile atrophy, but is an "abiotic process," some of the cases being due to faulty bone development and others to a reversed type of metabolic craniopathy as we see it in the frontal and other skull bones. The question of a birth injury or later trauma deserves further study.

COMMENT

Two cases of bone rarefaction are described, observed years after a skull injury —in one case a linear fracture, in the other a severe trauma to the parietal bones. It is our opinion that x-ray evidence of such thinning of the flat bones as a sequel of trauma is not uncommon but is rarely reported, as a connection between trauma and the bone changes occurring after a long interval is difficult to prove and the history is frequently lost. Furthermore, these cases rarely exhibit direct clinical symptoms.

Men of wide experience, as Pendergrass, Dyke, and Caffey, have observed this occurrence. The thinning and thickening of the parietal bones have frequently the same origin and are found in association in the same cases. Dyke described thickening of the bones of the cranium not only adjacent to the fracture, but even at a distance, in other homolateral bones. Less commonly he observed thinning of bone and erosion around the site of an old fracture. He also demonstrated congenital depressions of the upper part of the parietal bone following difficult labor and pressure of the infant's skull against the sacral promontory or the symphysis pubis of the mother. These depressions are broad and shallow.

Subperiosteal hematoma, which occurs often in the newborn, is according to Caffey a common cause of thickening of the parietal bones and occasionally we find subperiosteal bone formation demonstrated roentgenologically in cephalhematoma. In this connection our third case appears important, not only as affording a typical picture of the recently rediscovered thinness of the parietal bones, but because of the history of a severe accident.

The question arises whether trauma, either in the newborn or in later life, does not sometimes lead to "developmental thinness of the parietal bones." The histologic difference between metaplasia and dysplasia is not a fundamental one.

The underlying factor in all these posttraumatic changes is interference with the normal blood supply, the parietal bones having the largest collection of veins and the loosest trabeculation. Venous obstruction, as in other parts of the body, will result in either osteoporosis or sclerosis. Frequently these are found side by side.

The process of breaking down of bone into connective tissue should not be understood, however, as a simple process of osteolysis or decalcification due to hyperemia; as Baker pointed out, the law of Lériche and Policard—"Hyperemia causes bone absorption"—is at variance with many observations, such as active bone formation in the presence of an increased vascular supply and in artificial venous stasis.

The process in these cases of post-traumatic rarefaction is, in our opinion, one of aseptic necrosis followed by invasion of fibroblasts from the periosteum, with formation of osteoblastic and osteoclastic cells, leading either to bone absorption or deposition of new bone.

CONCLUSION

Skull injuries and skull fractures, while differing from fractures elsewhere, are frequently followed by localized decalcification or sclerosis. In some instances a localized osteoporosis or a fibrous substitution over a circumscribed area ensues many years later. These areas are progressive; they are usually painless and symptomless. X-ray therapy administered in one of our cases was without effect.

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EDITORIAL

The Origin of Cancer in Man

Recent work in the field of neoplasms further emphasizes the fact, long apparent, that no one cause will be found for the development of cancer in man. Already a number of agents are known to produce cancer directly or indirectly. Scrotal cancer in chimney sweeps gave the clue over 150 years ago for the long series of investigations that finally has produced the wide range of hydrocarbons proved to be carcinogenic for mice and some other animals. Among substances known to produce human cancer, shale oil, arsenic, and certain naphthylamine compounds have been well recognized. Radiologists are all too familiar with induction of carcinoma by long-continued roentgen or radium irradiation. Similarly, the hazard of leukemia as a result of chronic exposure to radiation has been established. A wide range of carcinogenic agents met with in various occupations have been studied by Hueper.

One of the astonishing features of many carcinogenic agents thus far worked with has been their high degree of specificity for various animals. Thus hydrocarbons extremely potent in the mouse sometimes are non-effective in the rabbit and other species of animals tested. In general, it can be stated that, with the exception of coal tar, some of the petroleum fractions and some of the physical agents, there are few substances which can be regarded as potential carcinogens for all species. Whether this variation hinges on ability of the animal to detoxify the various compounds or on a failure of the agent to produce the requisite type of tissue injury has not yet been clarified. The fact that some of the carcinogenic hydrocarbons are shown to be hydroxylated in the rabbit to a non-effective form suggests that detoxification may be a factor.

The carcinogenic effect of excessive ultraviolet radiation or insolation has been clearly brought out by the data bearing on the occurrence of skin cancer in southern and dry climates. Ultraviolet radiation is carcinogenic in experimental animals also.

The role of heredity, established as important in the genesis of animal tumors, has not yet been clearly defined in man, chiefly because no adequate data for studies of heredity have been available. In animals, particularly mice, intensive inbreeding has produced strains likely or unlikely to develop cancer of a given type. Such hereditary tendency may, however, be profoundly altered by a "milk factor." This substance, found in the milk of adult mice, is effective to a high degree in transmitting by ingestion to young mice the cancer tendency of the foster mother.

While the modes of origin of the majority of tumors in man are as yet not clearly determined, certainly contagion or infection can be effectively ruled out. No adequate evidence has yet been found to suggest incrimination of any bacterium or animal parasite as a causative agent for cancer. While certain tumors such as infectious lymphosarcoma in dogs, leukemia and endothelioma in fowls, papilloma and epidermoid carcinoma in rabbits, may be transmitted by a virus, no convincing evidence of viral origin of any human neoplasm has been produced.

Trauma has often been discussed as a possible cause of cancer. There is no doubt that it has been considered an effective agent far more often than it has proved to be one. Practically all the evidence is along the lines of the *post hoc ergo propter hoc* fallacy. In general, it can be said that there is no satisfactory evidence that carcinoma arises as a result of single

trauma. There are some instances in which sarcoma has followed single trauma with startling coincidence if not actually on an etiologic basis. The minimal criteria accepted by most authorities at the present time are as follows: (*a*) that previous integrity of the part should be established; (*b*) that adequacy of trauma should be established; (*c*) that a reasonable time interval should elapse between trauma and the appearance of tumor; (*d*) that the tumor should be of a type reasonably derived from cells of that part.

By and large, the various agents that produce cancer in man have an injurious effect as well as or in place of a stimulating effect, and it is very likely that increased cellular proliferation with or without mutation is an important factor in the appearance of human cancer.

The cell mutation theory of the origin of cancer has received considerable support from certain types of experimental production of cancer as well as from what we know of cell behavior in general. In particular, mutations induced by radiation through chromosomal injury have been of striking importance. The precancerous character of radiation changes induced in skin and other tissues has been all too clearly proved by our past experience. In general, it can be stated that those conditions that lead to long attempted repair with correlated proliferation of cells and repeated mitotic activity rather predispose to the chance of development of malignant growth. Chronic irritation with associated repair has long been considered as a responsible cause of cancer, and few malignant tumors in humans arise in previously intact tissue.

There is evidence that abnormalities of estrogenic hormonal balance may be participating factors in the causation of some tumors, particularly those of the breast and uterus.

No editorial on cancer in man would be complete without calling attention to the fact that all cancer research up to the present time has been on a shoestring scale. Research grants have all too often been in the range of $500 to $1,500 and made on an annual basis. Such support places a premium on nibbling at minor angles of the problem and neglecting significant but costly and time-consuming avenues of investigation. When we think that we can afford to spend two billion dollars and concentrate over a hundred thousand men to produce two bombs capable of killing or wounding over 300,000 human beings, the utter inadequacy of the present support of cancer research is only too apparent.

SHIELDS WARREN, M.D.

Dangers Inherent in Scattered Cathode Rays

An incident which occurred in the Department of Radiology of the Massachusetts General Hospital in December 1944 is particularly pertinent at the present time, inasmuch as it has to do with burns caused by scattered cathode rays. Six men, after very brief exposure to scattered electrons from a 1,200-kv. electrostatic generator which was under repair, experienced burns of varying severity. These burns had certain similarities to, but differed from, x-ray reactions, sunburn, and thermal burns. Certain factors characterized them, one being an apparently limited depth of penetration. The burns showed three distinct phases, the later phases making their appearance as the earlier ones were healing. The second and third phases developed both in areas previously uninvolved and in old healing areas.

The extent of scattering of cathode rays had not been appreciated, nor had the medical literature contained articles dealing with that phase of cathode irradiation. In order that this experience at the Massachusetts General Hospital may not be duplicated, publication of a detailed account seems necessary. This report will appear in the January 1946 issue of RADIOLOGY.

THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

The Thirty-first Annual Meeting of the Radiological Society of North America was held at the Drake Hotel, Chicago, Nov. 9 and 10, being limited to business sessions and the annual banquet. At the banquet announcement was made of the new officers; Dr. Lewis G. Allen made the presidential address and passed on to his successor, Dr. Lowell S. Goin, the Pfahler gavel. Among the guests were two representatives of the Inter-American Congress of Radiology, who extended to members of the Radiological Society a cordial invitation to attend the meeting in Habana, Nov. 17–22, 1946.

Dr. R. R. Newell had been chosen as the Carman lecturer. His lecture on "The Quality of Radiation," was not delivered but will appear in an early issue of RADIOLOGY.

The new officers of the Society are: President, Lowell S. Goin, M.D.; President-Elect, Frederick W. O'Brien, M.D.; 1st Vice-President, Paul C. Swenson, M.D.; 2d Vice-President, Wendell G. Scott, M.D.; 3d Vice-President, Ralph G. Willy, M.D.; Secretary-Treasurer, Donald S. Childs, M.D.; Librarian, Howard P. Doub, M.D. The newly elected member to the Board of Directors is John S. Bouslog, M.D.

AMERICAN COLLEGE OF RADIOLOGY OBSERVES THE FIFTIETH ANNIVERSARY OF RÖNTGEN'S DISCOVERY

On Nov. 8, 1945, fifty years from the very day on which Röntgen is believed first to have demonstrated the x-rays in his Würzburg laboratory, a banquet in commemoration of that significant discovery was held in Chicago under the joint auspices of the Commission on Public Relations of the American College of Radiology and the National Electrical Manufacturers Association. Some 900 persons were in attendance, including many who were in Chicago for meetings of the several national radiological societies.

Dr. Lowell S. Goin, President of the College, presided, and the principal address of the evening was given by Dr. Robert S. Stone. Dr. Stone spoke on "Radiology from Röntgen to the Eve of Atomic Energy," a subject on which his broad experience as a radiologist and his work as one of the group of scientists participating in the development of the atomic bomb enabled him to speak with special authority. Mr. A. C. Streamer, President of the National Electrical Manufacturers Association spoke on behalf of that organization and at 10:30 the guests heard the Association's national broadcast arranged in honor of Röntgen's great contribution to science and to humanity. President Truman's greetings were conveyed through a letter addressed to Mr. Mac Cahal, Executive Secretary of the American College of Radiology.

Dr. Warren W. Furey, President of the Chicago Roentgen Society, was chairman of the Committee on Arrangements, and the success of the occasion speaks eloquently of his efficient planning.

NEW ENGLAND ROENTGEN RAY SOCIETY

The New England Roentgen Ray Society observed the fiftieth anniversary of the discovery of x-rays at its meeting at the Harvard Club, Boston, Nov. 16, with a special program. The speakers were: Wm. J. Elliott, M.D., of Memorial Hospital, Worcester, Mass., on "The Use of X-Rays in Art"; Paul E. Tivnan, M.D., of Beverly Hospital, Beverly, Mass., on "Some Industrial Applications of X-Rays"; Joseph T. Walker, Ph.D., of the Massachusetts Department of Public Safety, on "The Application of X-Rays to Crime Detection"; Bertram E. Warren, Sc.D., Professor of Physics, Massachusetts Institute of Technology, on "X-Rays as a Tool of the Physicist"; Merrill C. Sosman, M.D., Clinical Professor of Radiology, Harvard Medical School, on "X-Rays in Medicine."

TEXAS RADIOLOGICAL SOCIETY

The recently elected President and Secretary of the Texas Radiological Society are Dr. Tom B. Bond and Dr. R. P. O'Bannon, both of Fort Worth. The next meeting of the Society will be held in Dallas on Jan. 14, 1946.

THE DETROIT ROENTGEN RAY AND RADIUM SOCIETY

The Detroit Roentgen Ray and Radium Society celebrated the anniversary of the discovery of the x-rays at its meeting on Nov. 1. The speaker of the evening was Dr. Otto Glasser, of Cleveland, whose intimate knowledge of Röntgen gave special interest to his remarks. It was a source of satisfaction on this occasion to hear that Röntgen's laboratory at Würzburg and his home at Lannep escaped damage during the bombings of Germany.

SECOND MEXICAN CONGRESS OF CANCER

The Second Mexican Congress of Cancer and Third Medical Week of the Occident will be held in the city of Guadalajara, Feb. 3–9, 1946. A special invitation to attend has been extended to members of the Radiological Society of North America.

DR. ANNETTE FEASTER HONORED

Dr. Annette M. Feaster, of St. Petersburg, Fla., has recently assumed the presidency of the Pinellas County Medical Society, the first woman to hold that office. Dr. Feaster is a diplomate of the American Board of Radiology and a member of the Radiological Society of North America. She is associated in the practice of radiology with her husband, Dr. O. O. Feaster.

REGIONAL COURSE ON CANCER

The first of a projected series of regional postgraduate courses to be sponsored by the commission on education of the American College of Radiology in conjunction with selected teaching institutions will be conducted during the week of Feb. 4 at the Philadelphia County Medical Society Building. This first and experimental course will be jointly sponsored by the College and the Philadelphia Roentgen Ray Society. Topics to be discussed include:

Feb. 4: Practical consideration of therapy problems concerned with the physics of radium and roentgen rays.

Feb. 5: Carcinoma of the female genital tract.

Feb. 6: Carcinoma of the breast.

Feb. 7: Carcinoma of the head and neck.

Feb. 8: Carcinoma of the skin and treatment of infections.

Feb. 9: Radiation treatment of blood dyscrasias and lymphoblastoma. Cancer detection clinics and important developments in cancer research.

The pathologic, clinical, and therapeutic aspects of the conditions under consideration will be covered and a round-table discussion of practical problems will be conducted. Teachers will be drawn from the fields of radiotherapy, surgery, oncology, physics, biophysics, and pathology. Advance registration may be made by writing to the Commission on Education of the American College of Radiology, 20 North Wacker Drive, Chicago 6.

In Memoriam

CHARLES BURDETTE PILLSBURY, M.D.

1893–1945

Dr. Charles Burdette Pillsbury, a member of the Radiological Society of North America, died Sept. 11, 1945, in Ypsilanti, Mich., after a brief illness.

Dr. Pillsbury was born in Duluth, Minn., May 22, 1893, and received his preliminary education in the Duluth public schools. His premedical education was obtained at the University of Minnesota, from which he entered the University of Michigan Homeopathic Medical School. Following his graduation in 1918, he was in charge of the X-Ray Department of the Homeopathic Hospital in Ann Arbor. In 1921 he opened an office in Ypsilanti, where he devoted himself to the practice of roentgenology and industrial medicine. Subsequently he gave practically all of his time to the former specialty. He was roentgenologist to Bayer Memorial Hospital and Ypsilanti State Hospital, both of Ypsilanti.

Charles Burdette Pillsbury, M.D.

Dr. Pillsbury was past president of the Washtenaw County (Michigan) Medical Society. He was a diplomate of the American Board of Radiology, a member of the Michigan Association of Roentgenologists, the Detroit Roentgen-Ray and Radium Society, the American College of Radiology, and Alpha Sigma Homeopathic Medical Fraternity. He was active in the American Legion and the Isaac Walton League.

GLENN W. FILES

1897–1945

Glenn W. Files, director of the Technical Service Department of General Electric X-Ray Corporation since 1934, and a member of that firm for twenty-six years, died in Chicago, on Sept. 11, at the age of forty-eight.

Mr. Files was born on Jan. 17, 1897, in Winfield, Kansas, and did his first work as a technician for a physician in that community. In World War I, he was a sergeant in the U. S. Army, serving in France as an x-ray instructor and technician. Following

Glenn W. Files

the war, he joined the Victor X-Ray Corporation, predecessor of General-Electric X-Ray Corporation, as an instructor under Dr. E. C. Jerman, director of the Education Department, whom he later succeeded in that position.

Mr. Files played an important part in the development of x-ray technic and instructional methods. He assisted in the publication of "Modern X-Ray Technic" (1928) and "X-Ray Studies and Advanced Radiographic Technic" (1931), edited by Dr. Jerman, and was himself editor in chief of "Medical Radiographic Technic," published in 1943. He was one of the founders of the American Society of X-Ray Technicians.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

CLASSIC DESCRIPTIONS OF DISEASE, WITH BIOGRAPHICAL SKETCHES OF THE AUTHORS. By RALPH H. MAJOR, M.D., Professor of Medicine, University of Kansas School of Medicine. A volume of 679 pages, with 158 illustrations. Published by Charles C Thomas, Springfield, Ill. Third edition, 1945. Price $6.50.

A TEXTBOOK OF SURGERY. By JOHN HOMANS, M.D., Clinical Professor of Surgery, Emeritus, Harvard Medical School. Compiled from Lectures and Other Writings of Members of The Surgical Department. With a Special Bibliographical Index and with illustrations by Willard C. Shepard and others. A volume of 1278 pages, with 530 figures. Published by Charles C Thomas, Springfield, Ill. Sixth Edition, 1945. Price $8.00.

THE OSSEOUS SYSTEM. A HANDBOOK OF ROENTGEN DIAGNOSIS. By VINCENT W. ARCHER, M.D., Professor of Roentgenology, University of Virginia Department of Medicine. A volume of 320 pages, with 148 plates. Published by The Year Book Publishers, Inc., 304 South Dearborn St., Chicago 4, 1945. Price $5.50.

Book Reviews

PEDIATRIC X-RAY DIAGNOSIS. A TEXTBOOK FOR STUDENTS AND PRACTITIONERS OF PEDIATRICS, SURGERY AND RADIOLOGY. By JOHN CAFFEY, A.B., M.D., Associate Professor of Pediatrics, College of Physicians and Surgeons, Columbia University; Associate Pediatrician and Roentgenologist, Babies Hospital and Vanderbilt Clinic, New York City; Consulting Pediatrician, Grasslands Hospital, Westchester County, N. Y., and St. John's Hospital, Yonkers, N. Y. A volume of 838 pages, with 711 illustrations. Published by The Year Book Publishers, Inc., 304 S. Dearborn St., Chicago 4, 1945. Price $12.50.

In Dr. Caffey's "Pediatric X-Ray Diagnosis," we have the answer, long deferred, to the need of an authoritative up-to-date text on the roentgenologic diagnosis of children's diseases. This is the first textbook on this subject to be printed in English in the past thirty-five years.

The author has arranged his material in six main divisions: (1) The Head and Neck; (2) The Thorax; (3) The Abdomen and Gastro-Intestinal Tract; (4) The Pelvis and Genito-Urinary Tract; (5) The Extremities; (6) The Vertebral Column. Under each of these headings, he describes the normal anatomy as disclosed roentgenologically, together with the commonly observed variations. The descriptions of disease processes, though they may appear in some instances to be rather brief, cover the essential points in excellent fashion and demonstrate the mature judgment of the writer. Bibliographic references are supplied at appropriate points, and a useful index is furnished.

The text is well illustrated with reproductions of films from the files of the Babies Hospital, New York, with which the author is associated, and by schematic drawings. The type is clear and readable and the paper and binding are of excellent quality.

To use the language of the day, the book is a "natural." It is difficult to see how any roentgenologist can afford to be without it.

RADIOLOGICAL SOCIETIES OF NORTH AMERICA

Editor's Note.—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit 2, Mich.

UNITED STATES

Radiological Society of North America.—Secretary, D. S. Childs, M.D., 607 Medical Arts Bldg., Syracuse 2, N.Y.

American Roentgen Ray Society.—Secretary, Harold Dabney Kerr, M.D., Iowa City, Iowa.

American College of Radiology.—Secretary, Mac F. Cahal, 20 N. Wacker Dr., Chicago 6, Ill.

Section on Radiology, American Medical Association.—Secretary, U. V. Portmann, M.D., Cleveland Clinic, Cleveland 6, Ohio.

ARKANSAS

Arkansas Radiological Society.—Secretary, J. S. Wilson, M.D., Monticello. Meets every three months and annually at meeting of State Medical Society.

CALIFORNIA

California Medical Association, Section on Radiology.—Secretary, Gordon King, M.D., Children's Hospital, San Francisco.

Los Angeles County Medical Association, Radiological Section.—Secretary, Roy W. Johnson, M.D., 1407 South Hope St., Los Angeles. Meets second Wednesday of each month at County Society Building.

Pacific Roentgen Society.—Acting Secretary, Frederick H. Rodenbaugh, M.D., 490 Post St., San Francisco. Meets annually with California Medical Association.

San Diego Roentgen Society.—Secretary, Henry L. Jaffe, M.D., U. S. Naval Hospital, San Diego, Calif. Meets first Wednesday of each month.

San Francisco Radiological Society.—Secretary, Carlton L. Ould, University Hospital, Medical Center, San Francisco 22. Meets monthly on the third Thursday at 7:45 P.M., first six months of the year in Lane Hall, Stanford University Hospital, and second six months in Toland Hall, University of California Hospital.

COLORADO

Denver Radiological Club.—Secretary, A. Page Jackson, Jr., M.D., 304 Republic Bldg., Denver 2. Meetings third Friday of each month, Denver Athletic Club.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Secretary, Max Climan, M.D., 242 Trumbull St., Hartford 3. Meetings bimonthly, second Thursday.

FLORIDA

Florida Radiological Society.—Secretary-Treasurer, J. F. Pitman, M.D., Blanche Hotel Annex, Lake City.

GEORGIA

Georgia Radiological Society.—Secretary-Treasurer, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta 3. Meets in November and at the annual meeting of State Medical Association.

ILLINOIS

Chicago Roentgen Society.—Secretary, Fay H. Squire, M.D., 1753 W. Congress St., Chicago 12. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

Illinois Radiological Society.—Secretary-Treasurer, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—Secretary, Frank S. Hussey, M.D., 250 East Superior St., Chicago 11.

INDIANA

The Indiana Roentgen Society.—Secretary-Treasurer, Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis 7. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Secretary, Arthur W. Erskine, M.D., Suite 326 Higley Building, Cedar Rapids. Holds luncheon and business meeting during annual session of Iowa State Medical Society.

KENTUCKY

Kentucky Radiological Society.—Secretary-Treasurer, Sydney E. Johnson, 101 W. Chestnut St., Louisville.

LOUISIANA

Louisiana Radiological Society.—Secretary-Treasurer, Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

Shreveport Radiological Club.—Secretary, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday, 7:30 P.M.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Secretary, Charles N. Davidson, M.D., 101 West Read St., Baltimore 1.

MICHIGAN

Detroit X-ray and Radium Society.—Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital, Detroit 1. Meetings first Thursday of each month from October to May, at Wayne County Medical Society club rooms.

Michigan Association of Roentgenologists.—Secretary, Bruce MacDuff, M.D., 201 Sherman Bldg., Flint 3.

MINNESOTA

Minnesota Radiological Society.—Secretary, A. T. Stenstrom, M.D., Minneapolis General Hospital, Minneapolis 26. Meetings quarterly.

MISSOURI

Radiological Society of Greater Kansas City.—Secretary, John W. Walker, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Friday of each month.

St. Louis Society of Radiologists.—Secretary, Edwin C. Ernst, M.D., 100 Beaumont Medical Bldg. Meets on fourth Wednesday of each month except June, July, August, and September.

NEBRASKA

Nebraska Radiological Society.—Secretary-Treasurer, Donald H. Breit, M.D., University of Nebraska Hospital, Omaha 5. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

NEW ENGLAND

New England Roentgen Ray Society.—Secretary-Treasurer, George Levene, M.D., Massachusetts Memorial Hos-

pitals, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

NEW HAMPSHIRE

New Hampshire Roentgen Society.—Secretary-Treasurer, Richard C. Batt, M.D., St. Louis Hospital, Berlin.

NEW JERSEY

Radiological Society of New Jersey.—Secretary, H. R. Brindle, M.D., 501 Grand Ave., Asbury Park. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called.

NEW YORK

Associated Radiologists of New York, Inc.—Secretary, William J. Francis, M.D., East Rockaway, L. I.

Brooklyn Roentgen Ray Society.—Secretary-Treasurer, Leo A. Harrington, M.D., 880 Ocean Ave., Brooklyn 26. Meets fourth Tuesday of every month, October to April.

Buffalo Radiological Society.—Secretary-Treasurer, Joseph S. Gian Franceschi, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen Society.—Secretary-Treasurer, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse 10. Meetings in January, May, and October.

Long Island Radiological Society.—Secretary, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—Secretary, Wm. Snow, M.D., 941 Park Ave., New York 28.

Rochester Roentgen-Ray Society.—Secretary, Murray P. George, M.D., 260 Crittenden Blvd., Rochester 7. Meets at Strong Memorial Hospital, third Monday, September through May.

NORTH CAROLINA

Radiological Society of North Carolina.—Secretary-Treasurer, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meets in May, and October.

NORTH DAKOTA

North Dakota Radiological Society.—Secretary, Charles Heilman, M.D., 1338 Second St., N., Fargo.

OHIO

Ohio Radiological Society.—Secretary, Henry Snow, M.D., 1061 Reibold Bldg., Dayton 2. Next meeting at annual meeting of the Ohio State Medical Association.

Cleveland Radiological Society.—Secretary-Treasurer, Carroll C. Dundon, M.D., 2065 Adelbert Road, Cleveland 6. Meetings at 6:30 P.M. on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*Secretary-Treasurer,* Samuel Brown, M.D., 707 Race St., Cincinnati 2. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—Secretary-Treasurer, L. E. Wurster, M.D., 416 Pine St., Williamsport 8. The Society meets annually.

Philadelphia Roentgen Ray Society.—Secretary, Calvin L. Stewart, M.D., Jefferson Hospital, Philadelphia 7. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22d St.

Pittsburgh Roentgen Society.—Secretary-Treasurer, Lester M. J. Freedman, M.D., 4800 Friendship Ave., Pittsburgh 24. Meets second Wednesday of each month at 6:30 P.M., October to May, inclusive, at The Ruskin, 120 Ruskin Ave.

ROCKY MOUNTAIN STATES

Rocky Mountain Radiological Society (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—*Secretary,* A. M. Popma, M.D., 220 North First St., Boise, Idaho.

SOUTH CAROLINA

South Carolina X-ray Society.—Secretary-Treasurer, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston 16.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee Radiological Society.—Secretary-Treasurer, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Dallas-Fort Worth Roentgen Study Club.—Secretary, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth, 4. Meetings on third Monday of each month, in Dallas in the odd months and in Fort Worth in the even months.

Texas Radiological Society.—Secretary-Treasurer, Asa E. Seeds, M.D., Baylor Hospital, Dallas.

VIRGINIA

Virginia Radiological Society.—Secretary, E. Latané Flanagan, M.D., 215 Medical Arts Bldg., Richmond 19.

WASHINGTON

Washington State Radiological Society.—Secretary-Treasurer, Thomas Carlile, M.D., 1115 Terry Ave., Seattle. Meetings fourth Monday of each month, October through May, at College Club, Seattle.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary-Treasurer, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee 3. Meets monthly on second Monday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, S. R. Beatty, M.D., 185 Hazel St., Oshkosh. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society in September.

University of Wisconsin Radiological Conference.—Meets first and third Thursdays, 4 to 5 P.M., September to May, inclusive, Room 301, Service Memorial Institute, 426 N. Charter St., Madison 6.

CANADA

Canadian Association of Radiologists.—Honorary Secretary-Treasurer, J. W. McKay, M.D., 1620 Cedar Ave., Montreal.

La Société Canadienne-Française d'Electrologie et de Radiologie Médicales.—General Secretary, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets on third Saturday of each month.

CUBA

Sociedad de Radiología y Fisioterapia de Cuba.—Offices in Hospital Mercedes, Havana. Meets monthly.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Great Vessels

The Digestive System

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Radiographic Visualization of an Intracerebral Dermoid Cyst. Sidney W. Gross. J. Neurosurg. **2:** 72–75, January 1945.

A case of intracerebral dermoid cyst is reported, unique only in that a plain x-ray film, before air injection, showed the lesion, which appeared as a large, regular, ovoid area of decreased density in the left frontal lobe. The patient had no focal signs or symptoms at any time. Roentgenograms are reproduced.

Healing Phenomena in the Sella Turcica after Treatment of Intrasellar Tumors. Olov Fr. Holm. Acta radiol. **24:** 495–510, Dec. 31, 1943. (In German.)

The pituitary body occupies only 50 to 70 per cent of the sella, the remainder of the space being filled with connective tissue. This implies that the size of the pituitary does not necessarily vary with that of the sella, and tumor may be present without enlargement or *vice versa*. The typical picture of tumor is a balloon-like expansion, but this cannot be absolutely relied upon.

Of about 200 cases of tumor (all explored but 2), 27 having serial roentgen study are analyzed to determine the characteristics of the healing phenomena. Of the 17 patients who have been free of recurrence, all but 2 had enucleation of the tumor, followed, with a single exception, by roentgen therapy. The other 2 had only exploration, followed by roentgen therapy. Of the 17, 9 showed no change in the roentgenograms following treatment. Decrease in sellar size was seen twice, increase 4 times, and the appearance of intrasellar calcification twice. In the 10 cases showing recurrence there was also progression of the roentgen signs. Although the series is small, the author feels it shows the value of more careful roentgenologic control in determining the progress of the lesion.

LEWIS G. JACOBS, M.D.

Sideropenic Dysphagia or Cancer of the Hypopharynx? Bengt S. Holmgren. Acta radiol. **24:** 455–461, Dec. 31, 1943. (In English.)

Iron deficiency is a fairly common condition, affecting women more often than men, and leads to a number of symptoms. Hypochromic anemia, low serum iron values, achylia or hypochylia, and various epithelial abnormalities are the most common. The dysphagia sometimes seen in this condition (Plummer-Vinson's syndrome) assumed special interest at Radiumhemmet (Stockholm) when it was noted that its symptoms were often found in female patients with cancer of the mouth or throat, and the possibility that the syndrome might predispose to cancer came into consideration. The typical roentgen picture is of one or several thin transverse bands constricting the esophagus, and in one case the author observed at autopsy a typical cancer at the site of the supposed sideropenic constriction. Two other patients, however, showed a similar constriction but no evidence of cancer over several years of observation. No case is made out for the predisposing effect of this condition to cancer, but at times the roentgenologic picture may make the diagnosis confusing.

LEWIS G. JACOBS, M.D.

Value of Contrast Filling of the Esophagus in X-Ray Examination for Goiter. Nils Frostberg. Acta radiol. **24:** 113–120, April 30, 1943. (In German.)

Frostberg recommends contrast filling of the esophagus in all cases of goiter. In a great number of cases, a pressure effect of the goiter on the esophagus can be demonstrated, and valuable information can be obtained regarding circular goiter forms or aberrant goiter branches between the trachea and esophagus.

E. A. SCHMIDT, M.D.

THE CHEST

On the Division of the Lung Segments (III). W. J. Pothoven and Eelco Huizinga. Acta radiol. **24:** 226–234, June 15, 1943. (In English.)

The present study deals with the division, into segments, of the right middle and lower lobes of the lung. [The other lobes were dealt with in previous publications. See Behr and Huizinga: Acta radiol. **19:** 399, 1938, abst. in Radiology **32:** 635, 1939, and Huizinga and Behr: Acta radiol. **21:** 314, 1940, abst. in Radiology **36:** 638, 1941.] The segmentation of the lung depends on the anatomy of the bronchial tree and is highly important for systematic bronchoscopic examination.

In the right middle lobe, the anatomical conditions are very constant: the bronchus proceeds ventrally and soon divides into a medial and a lateral branch. The architecture of the right lower lobe is much more complicated and shows numerous anatomical variations. The first constant large branch is the 1st dorsal bronchus; next follows the cardiac bronchus, which, however, may be absent. The next separate branch is a ventral branch, though it, too, may be absent. Finally, a ramification into a medio-dorsal and a ventro-lateral branch is observed. Consequently, five segments result in the right lower lobe, compared with two segments in the middle lobe.

In all, the authors differentiate ten segments in the right lung: three segments (apical, pectoral, and axillary) in the upper lobe; two segments (medial and lateral) in the middle lobe; five segments (upper dorsal, cardiac, upper ventral, lower dorsal, and lower ventral) in the lower lobe.

Considering the frequent difficulties encountered in complete visualization of the right bronchial tree, the authors' explicit directions for the bronchoscopist, based on these studies, are reprinted in full:

"The systematical bronchoscopy (in recumbent position) must, on the right side, be performed as follows. After determination of the bifurcation, the tube is inserted into the main right bronchus. The upper lobe bronchus soon goes off laterally, the orifice can be found by moving the head far to the left (Brünings, Jackson). The further ramifications cannot be seen. The head is replaced to its original position, the tube is moved on some centimetres further, by which the ramifications of the lower lobe bronchus can be seen in the depth. The next branch is the middle lobe bronchus, which goes off plainly ventrally, the mouth can be seen by displacing the head far downward. At a somewhat lower level the large first dorsal bronchus of the lower lobe follows. Now the head must be brought upward Then it is returned to its usual posi-

tion, after which the tube is inserted into the lower lobe bronchus. Now the cardia bronchus follows, which goes off medially and can easily be failed by bronchoscopy. The orifice can be found by turning the head to the right. After 1–2 cm. the first ventral bronchus of the lower lobe is seen which must be inserted in the same way as the middle lobe bronchus. Finally the inspection of the medio-dorsal and latero-ventral ramification of the lower lobe bronchus is made."

E. A. SCHMIDT, M.D.

Segmental Extension of Pulmonary Abnormalities. Eelco Huizinga. Acta radiol. **24:** 295–305, Aug. 31, 1943. (In German.)

In earlier publications the author has described a division of the lungs into segments according to anatomical and physiological evidence (see preceding abstract). This is of importance in disease, since it leads to a more precise localization of the cause of a collapse. While normally blockage of a minor bronchus will not lead to atelectasis, such an event may readily occur in the presence of inflammation. By a study of the collapsed area the minor bronchus in which the disease is located may be identified, and the finding confirmed by bronchoscopy.

A number of illustrative cases and pathological specimens are shown to demonstrate this type of collapse and similar segmental spreads in tuberculosis.

LEWIS G. JACOBS, M.D.

Some Remarks on the X-Ray Appearance and Prognosis of Infant Tuberculosis. Torfinn Denstad. Acta paediat. **29:** 303–338, 1942. (In English.)

A study was made of 120 tuberculin-positive children (64 boys and 56 girls) in a Norwegian children's home over a ten-year period. The children averaged 1 year and 7 months in age; 38 were under a year, 84 (70 per cent) under 2 years. They were x-rayed immediately after admission to the home and generally checked several times during their stay, which in some instances was as long as five years, but, on an average a year and four months.

In the overwhelming majority of cases of tuberculosis in infants and children, x-ray examination reveals changes in the lungs. Paratracheal and hilar adenitis, which appear early and may be the only signs of primary pulmonary infection demonstrable roentgenologically, are the most common findings. In most instances, opacities of the lung are also found, ranging from minute, hardly visible to diffusely saturated lobular lesions. Probably, in most cases these represent the primary focus with its perifocal reaction. The saturated lobar opacities, so-called epituberculosis, at times are of an expansive nature; at others, atelectatic, as demonstrated by two cases in this series. The difference in the x-ray appearance, however, does not enable one to draw any conclusion with regard to prognosis. The opacities nearly all recede within six to eighteen months. In two cases in which death occurred from caseous tuberculous pneumonia, saturated lobar opacities were found with the same atelectatic appearance as in one of the cases of benign epituberculosis. Small, round, clear areas resembling cavities are not of prognostic significance, as they are not infrequently seen when benign opacities start clearing.

The author concludes that there is little reason "to maintain epituberculosis as a distinct picture of disease." Probably, the substratum for these lobar opacities is the same as for the less extensive benign opacities, *viz.* a perifocal reaction, at times complicated by atelectasis.

In some cases diffuse opacities with a mild course, often producing no symptoms, appear at a later stage of the illness. These opacities are more transient, sometimes with the appearance of pure collapse, at others more saturated, without any atelectatic character. Such opacities have appeared in conjunction with acute infectious diseases (measles, whooping cough); on the other hand, most of the children underwent such intercurrent infections without any roentgen evidence of exacerbation.

The prognosis in infant tuberculosis is relatively favorable. The direct mortality rate in this series was 6 per cent, or 7 per cent computing the rate on those cases in which x-ray examination revealed pathological conditions in the lung. Five children died of meningitis, 2 of them with a miliary spread in the lung; 2 of caseous tuberculous pneumonia. Of 18 patients in the lowest age group, from birth to six months, only 2 died. The author adds a warning that "meningitis may shatter all expectations" after the tuberculous process in the lungs has apparently come to rest.

Bronchiectasis Following Atypical Pneumonia. Earle B. Kay. Arch. Int. Med. **75:** 89–104, February 1945.

During the past year 45 patients were treated for bronchiectasis at one Army hospital. The symptoms in 20 of these patients followed attacks of atypical pneumonia occurring during the winter of 1942-43. The diagnosis of atypical pneumonia was made elsewhere at the time of the original illness, and was confirmed by careful re-examination of the clinical records and roentgenograms at the hospital where the present study was conducted. In order to determine the permanency and extent of the bronchial and bronchiolar damage in these 20 cases, bronchography was repeated over a period of two to six months. In only 3 instances did the involved bronchi resume their normal contour and show evidence of clearing. In the remaining 17 patients the bronchiectasis appeared to be permanent.

Prior to the pneumonia these patients had no symptoms relative to the pulmonary system. The roentgenograms made at the time of induction into the Army were re-examined and found to be entirely within normal limits. The attacks of atypical pneumonia were characteristic in every respect except that they failed to show spontaneous healing in the usual period. After the acute episode had subsided, a cough remained, which became increasingly productive. Basilar râles persisted in the affected lungs. Serial roentgenograms showed an unresolved pneumonia.

Ten of the 17 patients with bronchiectasis had lobectomies, and in these cases pathologic verification of irreparable damage to the bronchial tree was obtained. The interval between the acute episode of atypical pneumonia and the operation varied from six to thirteen months. Representative case histories of 7 patients are presented. There are reported, also, 2 cases in which atypical pneumonia was followed by less severe bronchial changes—cases which the author believes might be regarded as intermediate stages in the development of bronchiectasis.

Spontaneous Mediastinal Emphysema with Pneumothorax Simulating Organic Heart Disease. Henry Miller. Am. J. M. Sc. **209:** 211–220, February 1945.

Four cases of spontaneous mediastinal emphysema associated with a left pneumothorax are described. The history and physical and electrocardiographic findings simulated those of organic heart disease.

Macklin (Canad. M. A. J. **36:** 414, 1937; Arch. Int. Med. **64:** 913, 1939; J. Michigan M. Soc. **39:** 756, 963, 1940) showed the probable mechanism of spontaneous mediastinal emphysema by demonstrating that air enters the perivascular sheaths of the pulmonary vessels, presumably through ruptures in the alveolar walls. This air eventually breaks through into the mediastinum. By the formation of large blebs along the vessels, the pulmonary circulation may be impeded. The air may extend from the perivascular sheaths into the connective tissues and dissect a path toward the pleura, where a subpleural bleb may be formed. While a pneumothorax could be produced by rupture of an emphysematous subpleural bleb, Macklin more commonly found a rent in the mediastinal wall which allowed access of air to the pleural cavity. From the mediastinum the air will follow the fascial planes into the neck, chest wall, about the pericardium, or retroperitoneally.

The onset of spontaneous mediastinal emphysema is characterized by the sudden development of precordial or substernal pain, which may radiate to the back, shoulder, neck, or left arm. The pain may last from several hours to several days. This pain must be differentiated from that of coronary occlusion, dissecting aneurysm, pericarditis, and pulmonary embolism.

The pathognomonic sign is a peculiar crackling or crepitant sound heard over the precordium synchronously with the heart beat. Roentgenographic demonstration of air in the mediastinum is diagnostic.

Associated pneumothoraces have always been found on the left side. Usually, the quantity of air is too small to be detected except by roentgen examination.

Most of the cases have been found in relatively young patients. In 3 of the cases described by the author there were electrocardiographic changes simulating those of myocardial damage. The other cases reported in the literature showed no such abnormalities. BENJAMIN COPLEMAN, M.D.

Early Diagnosis of Primary Cancer of the Lung. D. J. Steenhuis. Acta radiol. **24:** 263–284, Aug. 31, 1943. (In French.)

This is a rather lengthy but good review of the roentgen diagnosis and localization of pulmonary neoplasms, including bronchography and planigraphy as well as conventional radiography. The only new material has to do with the use of celluloid models of the lungs for study and orientation, an intriguing idea.

LEWIS G. JACOBS, M.D.

Alveolar Cell Carcinoma of the Lung. Kano Ikeda. Am. J. Clin. Path. **15:** 50–63, February 1945.

Alveolar-cell carcinoma of the lung originates in the lining cells of the alveoli and is distinguishable morphologically from the usual form of pulmonary carcinoma. The tumor occurs in two forms, the multiple nodular or the miliary type and the diffuse or the pneumonic type. It is thought to arise from multiple primary foci within the lung. General metastasis is not the rule, though the invasion of regional lymph nodes may be encountered. The exact genesis of the tumor is unknown. Clinically, the symptoms are atypical and misleading and may present a baffling problem.

One typical case of alveolar-cell carcinoma of the lung and two others which meet the essential clinicopathologic criteria of this tumor are presented, bringing the total cases recorded in the literature to not more than 50. There are a few pertinent clinical and pathologic considerations common to the three cases which distinguish this tumor from the usual pulmonary cancer. All three patients were women in the fifth decade; the course of the illness, from initial symptoms to death, was relatively short, being approximately seven months, five weeks, and seven months, respectively. In the second case symptoms referable to the lungs were absent throughout the illness, while in the third case, respiratory difficulties were encountered only in the last four weeks of life. In all of the cases, the roentgenogram of the chest was of the utmost assistance. It alone led to the discovery of extensive involvement of the lungs, altogether unsuspected, in Cases 2 and 3, but was interpreted as representing a metastatic miliary carcinoma. In the third case, because of a mass at the right upper hilum, a diagnosis of bronchiogenic carcinoma was finally made. Cough was not a prominent or constant feature; in none of the cases was bloody sputum recorded.

Roentgenologic Appearance and Pathology of Intrapulmonary Lymphatic Spread of Metastatic Cancer. H. Peter Mueller and Ronald C. Sniffen. Am. J. Roentgenol. **53:** 109–123, February 1945.

The roentgen appearance of lymphatic spread of metastatic cancer in the lungs is characterized by a prominent linear trabecular network of increased density, beneath which fine miliary nodules are less distinctly visualized. In most instances both lungs are evenly involved, but occasionally the lesions may be unilateral or predominantly so. Approximately 70 per cent of the cancers that give rise to lymphatic spread have been reported to originate in the stomach. The remainder have been found in the lung, breast, prostate, colon, gallbladder, tongue, kidney, and ovary. In 3 of the series of 10 cases here reported, the primary tumor was in the stomach, in 2 cases in the pancreas, in 2 in the cervix, in 1 in a bronchus, in 1 in the tongue; 1, a melanotic sarcoma, first appeared in an arm.

In general, this diffuse infiltrative type of metastasis occurs in younger persons, the majority of cases being seen between the ages of thirty and forty-nine. The important clinical findings are dyspnea, cyanosis, a productive cough, and rapid cachexia. The roentgen manifestations appear to be due to masses of tumor cells within dilated lymphatics around bronchi and blood vessels. In differential diagnosis, miliary tuberculosis, pulmonary congestion and edema, pneumoconiosis, sarcoid, primary fibrosis with emphysema, and atypical pneumonia must be considered. In the individual case a definite diagnosis may be difficult unless there are other roentgenologic or clinical evidences of malignant disease. L. W. PAUL, M.D.

Roentgen Picture of Silicosis in Different Industries. Torsten Bruce and Gunnar Jönsson. Acta radiol. **24:** 89–112, April 30, 1943. (In English.)

The x-ray appearance of silicosis varies considerably according to the occupation of the patient. The

special x-ray features of each occupation are mainly concerned with (1) the prominence of linear markings (striation) compared with the mottling; (2) shape, delineation, size, and distribution of the discrete nodules; (3) situation of the massive lesions and the emphysematous areas.

Extensive linear consolidations and diffusely outlined, irregular nodular shadows were seen in porcelain workers, quartz mill workers, and workers in silicon alloys. Less pronounced linear markings with more rounded, denser, and more sharply outlined nodular shadows were observed in sandstone grinders, furnace masons, steel cleaners, and molders, while the roentgenograms of iron ore drillers were characterized by round, distinctly outlined shadows of considerable radiopacity. The discrepancy between these observations and those of other investigators is discussed.

With regard to the size of the nodules, no uniformity exists among the different occupations. In iron ore drillers the nodules are almost all of identical size. Molders, masons, and drillers in quartz mines show the largest nodules in the middle fields and infraclavicularly. As far as the location of the nodules is concerned, they are more prominently seen in the infraclavicular regions and middle fields though, generally speaking, no part of the lung is entirely free of mottling. In steel foundry workers and furnace masons the nodules show a tendency to accumulate in the apical areas and the lateral portions of the middle fields; a more even and general distribution of the mottling over both lungs is the rule in iron mine drillers. In quartz mine and iron ore drillers the nodules usually attain the size of a pea before coalescing to form massive conglomerations. So-called "egg-shell" consolidations in the hilar lymph nodes are seen chiefly in sandstone workers but are also occasionally present in second-stage silicosis of molders and steel cleaners. According to some observers, this "egg-shell" appearance is caused by infiltration of calcium underneath the capsule in the lymph node. Bronchographically, the deposits can be shown to lie outside the bronchi.

The location of the massive lesions and the deformation and emphysematous changes caused by contraction of the lung give the picture its typical appearance in the far-advanced stages of silicosis. The consolidations coalesce where the mottling is greatest; massive lesions, therefore, are generally situated infraclavicularly or in the upper parts of the middle fields, perhaps slightly higher in foundry molders and steel cleaners than in porcelain workers and quartz millers. In quartz mine drillers the massive lesions are situated in the lower parts of the middle fields or even basally. In iron mine drillers, the confluent areas have no definite site of predilection. In advanced silicosis, the lateral view is highly useful for the localization of the massive lesions. Situation of the conglomerates posterior to the hilus is such a constant feature in the silicosis of porcelain workers, quartz millers, foundry molders, steel cleaners, and furnace masons that location of lesions anterior to the hilus in these occupations raises the suspicion of non-silicotic etiology.

Emphysema may be expected to develop anywhere in the air-carrying pulmonary tissue but, since the massive lesions generally lie dorsally and above the hilar regions, the emphysematous areas show a predilection for the ventral and basal sections of the lung. Lateral views are necessary to demonstrate the borderline between consolidated and emphysematous areas. This line of demarcation shows a different course in different occupations. In porcelain workers and quartz millers, it runs diagonally from the jugular fossa through the hilus posteriorly and inferiorly toward the dorsal thoracic wall. In steel cleaners the lateral picture is dominated by the emphysema; the massive lesions occupy a smaller area superodorsally, which is separated from the emphysema by a semicircular line. In foundry molders and furnace masons, the lateral roentgenogram shows the consolidated region like an island surrounded on all sides by air-carrying emphysematous tissue. In the third-stage silicosis of iron mine drillers, where the centers of contraction have no sites of predilection, no characteristic borderline is visible between consolidated and emphysematous areas.

E. A. SCHMIDT, M.D.

Bronchographic Studies in Advanced Silicosis. Torsten Bruce and Gunnar Jönsson. Acta radiol. **24**: 206–216, June 15, 1943. (In English.)

By means of bronchography, the authors studied the displacement of the bronchi caused by advanced silicosis. Five patients (2 steel workers, a quartz miller, a porcelain worker, and an iron ore driller) were examined, 4 of whom presented the typical silicotic distribution radiating from the hili and resulting in a similar pattern of displacement, while the fifth patient (the iron ore driller) showed basal lesions and a correspondingly different type of bronchial displacement.

The degree and direction of the bronchial displacement are directly dependent on processes of contraction. In the first 4 cases the center of contraction lay behind, above, and lateral to the hilus, and the ventral branches of the right eparterial bronchus and of the first left hyparterial bronchus were displaced upward and backward. The change of the peripheral bronchi was less marked, and the contraction exerted only a slight effect on the position of the dorsal bronchi. In the fifth case, where the center of contraction was located in the base of the lung, especially on the right side, there was considerable downward displacement of the eparterial bronchus combined with rather poor lipiodol filling of the other ventral bronchi. The dorsal bronchi were not displaced and were of "ordinary appearance."

E. A. SCHMIDT, M.D.

Toxic Properties of Silica. I. Bronchoconstrictor Effect of Colloidal Silica in Isolated Perfused Guinea Pig Lungs. Giles F. Filley, John G. Hawley, and George W. Wright. J. Indust. Hyg. & Toxicol. **27**: 37–46, February 1945.

While this paper does not concern the roentgen aspects of silicosis, it is briefly noted here for the sake of calling it to the attention of those who are interested in the mechanism of the respiratory disability sometimes observed in silicotics. This, as the authors point out, may be of greater severity than would be expected from the x-ray findings.

Colloidal silica was found to produce a specific pharmacologic bronchoconstriction in isolated perfused guinea-pig lungs, apparently due to constriction of the smooth muscle fibers, but silica in soluble form was without such effect. Particulate silica produced mechanical obstruction in the tracheobronchial tree which obscured any possible pharmacological action, and this made impossible any definite conclusions as to its role in bronchospasm in human silicosis.

Occupational Illnesses in Cotton Industries. II. Chronic Respiratory Problems. Wayne L. Ritter and Morris A. Nussbaum. J. Indust. Hyg. & Toxicol. **27:** 47–51, February 1945.

A cross-sectional survey was made of employees exposed to Upland cotton in Mississippi. Here, it has been the policy of the cotton industry over a number of years either to shift employees with "asthma" to some other job or to discharge them from work entirely. (The term asthma is applied loosely to any chest condition from chronic bronchitis, through pleurisy, to dyspnea.) Most employees with complaints of asthma are thus weeded out of the cotton industry. After a considerable search, 12 were eventually located. All were Negro males, ranging in age from thirty-seven to seventy, and all were or had been employed in cotton seed mills, either in the linter rooms or in the large seed storage bins. To make certain that the asthma could be precipitated by exposure to cotton dust, 2 of the men were taken into a lint room; both suffered asthmatic seizures. Physical examinations of this group of asthmatics showed no barrel-shaped chests, loss of chest expansion, or other abnormalities. Roentgenograms revealed no evidence of bronchiectasis, emphysema, fibrosis, or indeed any suspicious or undiagnosed pattern.

In Great Britain the Byssinosis Act of 1940 officially recognizes the possibility of permanent disability after prolonged exposure to cotton dusts and provides compensation to employees thus disabled following at least twenty years work in cotton mills. In Mississippi, only 26 people could be found who had done such work for this length of time; 14 of these had worked in excess of thirty years, one of them for forty-seven years. None of these men felt that their employment had in any way affected their health. Physical examinations and chest films revealed no pulmonary changes in this group.

Inquiries into the occupation of all persons on whom a diagnosis of bronchiectasis or emphysema had been made at the State Tuberculosis Sanatorium failed to show a single instance of employment in any of the dusty operations of the cotton industry.

No evidence was found in these studies to clarify or even support the existence of byssinosis as a clinical entity among employees exposed to Upland cotton. It was concluded that allergic individuals may develop a hypersensitivity to the high concentrations of cotton dust associated with some of the manufacturing processes in the cotton industry. There is apparently a wide variation in the severity of asthmatic episodes that result from this exposure.

Four Primarily Radiological Lesions Found in Traumatic Chest Cases: Preliminary Report. C. J. Hodson. Brit. J. Radiol. **17:** 296–299, October 1944.

In a series of 250 chest casualties, four lesions were not infrequently demonstrated which have not previously been described:

1. Solid missile tracks were seen in 12 cases. When a missile traverses a lung it may leave a track demonstrable radiologically as a linear shadow. At first, this may be barely visible, but with subsequent bleeding and fibrosis it becomes increasingly apparent, and after two or three weeks may be seen as a clear-cut shadow 1.0 to 1.5 cm. in width. This track may direct the observer to a bullet otherwise invisible. As healing proceeds, the track becomes narrower. It may remain as a fine line or disappear.

2. Air-containing missile tracks are due presumably to the draining of the contents of a solid track by a bronchus. Six such cases were observed, all associated with bone damage at one end and a foreign body and exit wound at the other. The tracks varied from 4 to 10 cm. in width. Viewed end-on, they appear round or oval and may resemble cavities. They heal slowly and may leave a linear streak.

3. Extrapleural hematomata were observed in association with rib fractures and foreign bodies coming to rest beneath the pleura. They appeared as rounded to fusiform densities on the chest wall and resolved slowly. Unlike pleural effusions, they do not spread along the chest wall.

4. Lung "contusion" is a name applied tentatively to a diffuse shadow seen in many injuries, clearly not due to pleural effusion. It may occur in any type of trauma, but is observed particularly in contusions and blast injuries and in tangential wounds. The pathology has not been determined. Hemoptysis may be present.

SYDNEY J. HAWLEY, M.D.

Radiographic Changes in the Lungs After Strangulation. R. V. Lee and H. W. Jamison. Air Surgeon's Bull. (No. 7) **1:** 14, July 1944.

A 21-year-old man was caught in a crashed airplane in such a way that his neck was constricted, shutting off the trachea completely. Immediately after the accident he was conscious and beating the ground frantically. In the seven to twelve minutes which passed before his release the patient became profoundly cyanotic and lapsed into unconsciousness. When removed from the wreckage he showed no signs of life for four or five minutes, was flaccid and apneic, with pupils dilated and no perceptible pulse. Artificial respiration and other measures were instituted and after twelve hours the patient was apparently normal.

Roentgenograms of the chest were taken at approximately three hours, fifteen hours, and thirty-seven hours after the accident. The first film revealed diffuse, mottled infiltration throughout both lungs, accentuated in the parahilar regions and fading toward the periphery and lung bases, resembling acute, intensive passive congestion and edema such as are seen following acute coronary occlusion. The heart appeared moderately dilated. Fifteen hours after the accident most of the extensive mottling had cleared, leaving only thickened hilar and bronchovascular trunk markings with hazy peribronchial residual edema. The heart measured 8 mm. less in transverse diameter than on the original film. Thirty-seven hours following the accident the patient was ambulatory, the lungs were entirely clear, and the heart was normal in size and shape. The roentgenograms are reproduced.

Pulmonary Changes in Cardiospasm. Lloyd E. Hawes and Arthur B. Soule, Jr. Am. J. Roentgenol. **53:** 124–128, February 1945.

Two cases of cardiospasm are reported in which there were extensive roentgen changes in the lungs without significant pulmonary signs or symptoms. In one patient with a long history of cardiospasm there was an increasing interstitial pulmonary fibrosis. The second patient showed an area of increased density in the right upper lobe which persisted without change over a period of three years. It was thought to represent an area of

fibrosis which developed from inhalation pneumonitis. Four types of pulmonary complications associated with cardiospasm have previously been reported: basal pneumonitis, lung abscess, bronchiectasis, and pleural effusion. In these cases there have been pulmonary symptoms in addition to those due to the cardiospasm. The cause of these various lesions seems to be the inhalation of fluid from the reservoir in the esophagus, during spasms of coughing or while the patient is asleep. L. W. PAUL, M.D.

Celothelioma of the Epicardium: Report of Case. C. J. Hansson and N. Söderström. Acta radiol. **24:** 183–189, June 15, 1943. (In English.)

The authors report a case of malignant tumor of the epicardium in a 51-year-old man who was admitted to the hospital with the preliminary diagnosis of "myocardial damage, possibly pericarditis." The x-ray examination showed only slight enlargement of the superior mediastinum. Electrocardiograms revealed a definitely pathologic condition, resembling the "T type" seen in coronary thrombosis. Venography, with the aid of perabrodil, revealed a bilateral block of the axillary vein at a point approximately on a level with the clavicle. While the downward extent of the obstruction into the superior vena cava could not be determined, the fact that the azygos vein showed contrast filling indicated that it did not reach farther down than to the point where the latter vein emptied into the vena cava. More detailed study was prevented by the patient's condition, which was characterized by increasing cyanosis and dyspnea.

Autopsy showed tumor involvement of the heart at the apex, on the anterior wall of the right ventricle, and in the posterior wall of the right auricle. The tumor infiltrated into the muscular tissue, the pericardium, the endocardium, and the intima of the pulmonary artery. The pathological diagnosis was malignant endothelioma.

The striking clinical features in this case were the absence of definite roentgen signs pointing to a mediastinal tumor and the marked electrocardiographic changes of the coronary type. At an early stage of the disease, the patient received radiation therapy, but the dosage was apparently too small to influence the tumor.
E. A. SCHMIDT, M.D.

Calcific Aortic Valve Stenosis: A Clinico-Pathologic Correlation of 22 Cases. Nathaniel E. Reich. Ann. Int. Med. **22:** 234–251, February 1945.

Twenty-two consecutive cases of pure calcific aortic valve stenosis found at the autopsy table of Kings County Hospital (Brooklyn, N. Y.) from 1934 to 1942 have been reviewed. They were carefully selected on the basis of calcareous infiltration of the aortic valve leaflets only, in the absence of significant degrees of involvement of other valves. Cases with other valvular defects were avoided so that the effects of a pure aortic stenosis on the size and weight of the heart, symptomatology, physical findings, and electrocardiogram could be more clearly evaluated.

The diagnostic criteria include the history, characteristic pulse, palpable thrill over the base of the heart, loud rough systolic murmur at the base of the heart or entire precordium, heard loudest over the aortic valve, decreased intensity or absence of the second aortic sound, and cardiac hypertrophy. Visualization by fluoroscopy, occasional demonstration on the roentgenogram, and electrocardiographic changes are helpful laboratory aids. The cardinal symptoms are evidences of left ventricular failure, angina pectoris, dizziness, and syncope.

The roentgenographic and fluoroscopic diagnosis of calcium deposits in the valve leaflets by special technic has been amply described elsewhere (Sosman and Wosika: Am. J. Roentgenol. **30:** 328, 1933). In 36.4 per cent of the present series, the diagnosis based on history and physical findings was confirmed by autopsy. The frequency of identification may be almost doubled (64 per cent) by the additional fluoroscopic demonstration of calcification of the aortic leaflets or annulus. Arteriosclerotic dilatation of the aorta may be differentiated by roentgenographic demonstration of the dilatation and calcific plaques in the aorta rather than calcification in the region of the valve.

Electrocardiographically, left axis deviation and T-wave negativity were helpful in differentiation of aortic insufficiency and mitral lesions, since these tend to produce hypertrophy in the right chambers as well, with resultant right ventricular strain.

Rheumatic fever and arteriosclerosis have a definitely established relationship to calcific aortic valve stenosis. The latter was three times as important etiologically in the author's series as the former. Subacute bacterial endocarditis would appear to be a rarer cause, the calcification occurring as part of the healing process after the patient has become bacteria-free.

Calcific aortic valve stenosis is characterized pathologically by a tendency to hyalinization of the connective tissue, depositions of lipoid material in the aortic valve ring and in the aortic valve, and subsequent calcification of the affected tissues. In the rheumatic type, calcification begins in the ventricular aspect of the distal third of the cusps; in the arteriosclerotic types it begins at the base of the aortic surface. The degree of calcification closely parallels the degree of stenosis.

The greatest number of cases in the series reported occurred in the age group 50 to 80 years. The ages ranged, however, from 25 to 82, with an average of 59. A rheumatic etiology, as would be expected, was more frequent among the younger patients. Males outnumbered females 4 to 1 in the rheumatic group; arteriosclerotic involvement was 7 times more frequent in males. The average age in the arteriosclerotic group was twenty-three years more than in the rheumatic group.

Following the onset of symptoms, the total duration of the illness ranged from three days to eight years. The course was generally slow and progressive, the valve becoming more and more stenosed as more calcium was deposited on the leaflets. The rheumatic group had a tendency to a longer period of hospitalization than the arteriosclerotics. Cardiovascular and extracardiovascular causes of death were about equally divided, but of the former, pulmonary edema and congestive heart failure predominated. Sudden death may be caused by myocardial infarction due to acute coronary occlusion or coronary insufficiency, severe cerebral ischemia, cardiac standstill, ventricular fibrillation, hypersensitive carotid sinus reflex, or obstructing thrombi formed on the stenosed aortic valve.

The author concludes as follows: "In the absence of hypertension and definite mitral valve involvement,

a systolic murmur at the aortic area should suggest calcific aortic valve stenosis. This possibility becomes greater in the presence of dizziness, precordial pain, regular sinus rhythm, cardiac enlargement, and an absent second aortic sound. Roentgenologic and especially fluoroscopic studies, as well as electrocardiographic findings, may verify this."

STEPHEN N. TAGER, M.D.

Clinical and Theoretical Considerations of Involvement of the Left Side of the Heart with Echinococcal Cysts. A Review of the Literature, with a Report of Five Cases, Including One Observed by the Authors. John H. Peters, Lewis Dexter, and Soma Weiss. Am. Heart J. **29:** 143–167, February 1945.

The authors analyzed 56 reported cases of hydatid cysts of the left heart, together with 5 new cases and one additional case which was under their observation during its terminal phase, giving the pathogenesis, clinical diagnosis, prognosis, and treatment. They are chiefly concerned with the rare cases in which the primary infection passed through the hepatic and pulmonary filters to involve the heart and, secondarily, the peripheral organs. Echinococcosis is predominantly a hepatic and pulmonary disease. Some doubt exists regarding the mode of transmission from animals to man. It is assumed to be by way of the digestive tract. Larvae leave the digestive tract, enter the portal circulation, and most of them are filtered out by the liver, where an unknown and variable number survive to form cysts. A small number of the larvae pass through the liver and enter the heart and pulmonary circulation. About one-third of them are retained in the capillary bed, and the remainder pass into the systemic circulation. A small percentage of the primary cysts are formed in the heart, the larvae having entered by way of the coronaries, mainly the right.

A certain proportion of the encysted larvae die, and unless the cysts cause mechanical difficulties, they become fibrosed, with or without calcification, and are discovered only by accident at operation or autopsy. Living cysts grow at a fairly constant rate; a certain proportion rupture, and spread of the disease frequently follows. Multiple cysts may develop in the tissues adjacent to the site of rupture. Distant spread of the disease follows rupture into the peritoneal cavity, large blood vessels, biliary passages, respiratory or digestive tract, unless the infesting material is completely expelled in bile, feces, sputum, or vomitus.

There are 5 main types of cardiac cysts: (1) dead cysts, usually found at autopsy; (2) living intact cysts, which, if detected roentgenologically, should be extirpated to prevent further growth or subsequent rupture; (3) cysts which have ruptured into the pericardium, causing adhesions, with or without formation of secondary cardiac cysts; (4) pedicled cysts in the heart chambers, which may interfere with valvular function, and are found from time to time at autopsy; (5) cysts which have ruptured one or more times into the heart chambers, causing systemic disturbances.

Symptoms arise from the effect of primary cysts on the function of the myocardium, either as a result of myocardial destruction, interference with valvular function, or disturbance in conduction. When a cyst ruptures, systemic disturbances follow. There may be arterial occlusion by daughter cysts or other material. Germinal elements may be disseminated into the peripheral tissues and organs, where they may or may not survive and produce secondary cysts. There may be an allergic response on the part of the body to the protein substance liberated.

The diagnosis of cardiac echinococcosis is essentially the same as of infestation of other organs. Cardiac cysts tend, however, to be asymptomatic, and may be recognized only roentgenologically (if calcified). The presence of cysts in peripheral organs may serve as a clue and lead to roentgen detection of a cyst in the heart. Sudden unexplained anaphylactoid collapse in persons born in regions where the condition is endemic should arouse suspicion.

The article concludes with reports of 8 cases (2 previously reported) and a long bibliography.

HENRY K. TAYLOR, M.D.

THE GREAT VESSELS

Clinical and Pathological Findings in Aortic Atresia or Marked Hypoplasia of the Aorta at Its Base. Helen B. Taussig. Bull. Johns Hopkins Hosp. **76:** 75–82, February 1945.

Atresia or marked hypoplasia of the aorta at its base is a rare malformation incompatible with life for more than a few days. Two cases of this condition with remarkably similar clinical findings are reported. Both infants were cyanotic at birth and throughout their brief lives. Within the first few days both showed enormous cardiac enlargement and evidence of cardiac failure with marked engorgement of the liver and an extremely weak pulse. Fluoroscopy showed that the hypertrophy of the heart was primarily due to enlargement of the right auricle and right ventricle. In the anteroposterior view the heart appeared enlarged and the pulmonary conus markedly distended, indicating that the pulmonary artery was normally placed. Examination in the left anterior oblique position showed that the anterior margin of the cardiac shadow extended forward nearly to the anterior chest wall. This finding confirmed the impression that the right ventricle was huge. The posterior margin of the cardiac silhouette did not extend further back than normal, showing that the left ventricle was not enlarged. Films were not obtained in either case, due to the critical condition of the patients. Autopsies confirmed the clinical diagnosis of complete or functional atresia of the aortic orifice.

Aneurysms of the Abdominal Aorta. Joseph Epstein. Ann. Int. Med. **22:** 252–270, February 1945.

Aneurysm of the abdominal aorta must be considered in the differential diagnosis of obscure abdominal disorders. A general accord as to the age distribution of the two major groups of aneurysms is recognized, the syphilitic occurring in the fourth and fifth decades and the arteriosclerotic in the sixth and seventh. Other etiologic features than syphilis and arteriosclerosis are trauma, such as perforating gunshot or stab wounds of the abdomen, contiguous extra-arterial disease with secondary injury to the vascular wall, inflammatory vascular lesions such as tuberculosis, streptococcus infections, and rheumatic fever.

Aortitis is the most frequent lesion of tertiary syphilis and may be its sole manifestation. The saccular aneurysm characteristic of the disease is the result of an inflammatory process which begins as a mesarteritis. In arteriosclerotic aneurysms the arterial wall is

weakened throughout because of progressive medial changes. After the elastic fibers degenerate, they are replaced by fibrous hyaline tissue, a non-inflammatory process in which the change progresses from the intima to the adventitia. The increasing dilatation of the vessel which ensues reflects its inability to resist intravascular tension.

The pressure of the enlarging aneurysm produces a chronic inflammatory reaction in the cancellous bone, with consequent erosion of the vertebrae and sometimes of the lowermost ribs. The cartilage, being avascular, does not show this reaction and consequently is preserved. The twelfth thoracic and first two lumbar vertebrae are the most frequent sites of erosion. The left anterior aspect is the earliest site of resorption, a phenomenon explained by the position of the aorta at these levels. Subsequent resorption of bone results in the exertion of pressure on nerve roots and in extreme cases on the spinal cord, causing paraplegia.

Roentgenologically the aneurysm may indicate its presence by the diverse changes the expanding lesion produces on contiguous organs and skeletal structures. The protrusion of an aneurysmal sac ventrally and to the left predicates that the best evidence of bone resorption will be seen in lateral and lateral oblique projections. *The intervertebral disks are never destroyed.* Vertebral erosion in the presence of the senile arteriosclerotic aneurysm was not observed in any of the author's 9 cases. The diaphragm may be elevated, thereby changing the cardiophrenic angles. The stomach may be indented, or the kidney and ureters displaced. Direct roentgen examination of the abdomen may reveal the arteriosclerotic wall of an aneurysm as a thin curved line of calcification lateral and anterior to the vertebral column.

As a result of rupture followed by retroperitoneal and intraperitoneal hemorrhage, a number of distorting phenomena of the viscera may occur. Rupture may occur into the pleural cavity, the mediastinum, or the gastro-intestinal tract. Intestinal obstruction, both mechanical and paralytic, has been produced by this mechanism. Portal, splenic, and mesenteric vein thrombosis have been reported. Rupture of the aneurysmal sac may result in sudden death.

Aneurysms of the abdominal aorta are notorious for the latency of their clinical expression. Pain, of varying nature and intensity, is the predominating symptom. It may be caused by hemorrhage into the perirenal space, by vertebral erosion, by pressure on the dorsal nerve roots, or by displacement of the kidney and ureter with obstruction.

The cardinal physical finding is an abdominal mass, usually in the epigastrium, and characteristically transmitting an expansile pulsation. The differentiation from a mass of cancerous retroperitoneal lymph nodes may be difficult because not only may the latter mass pulsate, but it may be associated with vertebral erosion. The intervertebral disks, however, are destroyed in neoplastic disease and the vertebrae involved present an irregular, patchy, ragged outline with a worm-eaten appearance, not characteristic of erosion due to aneurysm. Other pathologic entities which may be simulated by abdominal aortic aneurysms include retroperitoneal sarcomata, gumma of the liver, and omental tumors.

Since the kidney and ureter are often displaced by an aneurysm, as has been evidenced by many postmortem examinations, the radiologist must employ urography in the investigation of abdominal aortic lesions. Such displacement was observed in 2 of the author's cases.

The correct diagnosis was made in 4 of the 9 cases reported here. The symptoms were mostly those suggestive of renal disease, resulting in the diagnosis of renal calculus, pyelonephritis, and perinephric abscess. Gastro-intestinal cancer was considered in 2 cases, an appendiceal abscess in one, and a perforated viscus in another.

In two patients the diagnosis of calcified aortic abdominal aneurysm was made as an incidental observation. In these cases there were few or no symptoms or physical findings to direct attention to the aneurysm, and the roentgenograms alone established the diagnosis.

Roentgenographic examination was the most fruitful of the laboratory procedures. Calcification in the dilated vascular wall was present in 6 patients and was the most frequent finding. The serologic reaction was positive in two cases, and in both of these autopsy revealed the presence of vascular syphilis.

The cases of aortic abdominal aneurysm presented focus attention on the importance of painstaking roentgen examination in the diagnosis of this obscure malady. The most recent contribution has been made by intravenous urography. The importance of identification of vascular calcification must be stressed, because even a thin, small deposit may, by its location, lead to a proper diagnosis. Pneumoperitoneum was helpful in one case. STEPHEN N. TAGER, M.D.

Diagnosis of Aneurysms of the Abdominal Aorta. Aguinaldo Lins and Fernando de Morais. Rev. clin. de São Paulo **16:** 79–84, 1944.

After a short historical introduction, the authors call attention to the relatively high frequency of abdominal aneurysms among local workers in Recife, Brazil, and conclude that it is possible to make the diagnosis in most cases without resorting to the complex technic of aortographic examination. Symptomatology, with special reference to pain, is discussed. Forward displacement of the stomach is noted. Calcification is evaluated. While erosions of the vertebral bodies are not uncommon, kyphosis is never found. Some prefer the use of pneumoperitoneum or visualization of the digestive tract by use of barium or air. Illustrative examples of the condition as shown in roentgenograms are given, and various aneurysmal, arterial, and cardiac tracings are presented. SEBASTIO V. FRANCO, M.D.

Arteriographic Findings in Thrombosis of the Internal Carotid. S. Erikson. Acta radiol. **24:** 392–402, Oct. 31, 1943. (In German.)

Nine cases of thrombosis of the internal carotid artery are presented, 6 in males and 3 in females. Roentgenograms from some of these are reproduced.

F. ELLINGER, M.D.

THE DIGESTIVE SYSTEM

Roentgenography of Small Zenker's Diverticula (Pulsion Diverticula) During Various Phases of Swallowing. Bengt S. Holmgren. Acta radiol. **25:** 40–53, Feb. 29, 1944. (In German.)

After discussion of the various theories of the origin and development of pulsion diverticula of the esophagus

the author describes 8 cases observed in 6 female and 2 male patients between 63 and 75 years of age. It was found that, during the act of swallowing, the diverticulum disappears as the contrast medium passes the inferior part of the hypopharynx and reappears as soon as the medium has passed the upper orifice of the esophagus. This phenomenon is not observed in larger forms of Zenker's diverticulum. Excellent illustrations are included. F. ELLINGER, M.D.

Contribution to the Roentgen Examination of the Stomach. Y. Seuderling. Acta radiol. **24:** 384–391, Oct. 31, 1943. (In German.)

The author reports 2 cases of snail-like contraction of the lesser curvature of the stomach in male patients 33 and 38 years of age. The condition occurs as a rule following chronic ulcer. In one of the patients the ulcer was no longer demonstrable. In the other it persisted and the stomach was of the hourglass form. In each instance, the organ showed roentgenographically a "tobacco-pouch" appearance. Symptoms had been present five and eleven years, respectively, but were not striking. F. ELLINGER, M.D.

An Accessory for Radiographic Examination of the Stomach. Y. Seuderling. Acta radiol. **25:** 56–58, Feb. 29, 1944. (In German.)

To facilitate administration of the barium meal, the author uses a metal goblet containing a glass, attached to the cassette in such a way as always to remain in a vertical position. To make it easier for the patient to find the glass in the dark room, a label in fluorescent letters is provided. F. ELLINGER, M.D.

X-Ray Diagnosis of Benign Tumors of the Stomach. Gösta Forssman. Acta radiol. **24:** 135–165, April 30, 1943. (In German.)

The author reports a series of 30 benign tumors of the stomach which he observed during a ten-year period. Simple polyps were most frequently encountered (11 cases), followed by myoma (8 cases), polyposis (6 cases), and papilloma (3 cases). There was one case each of neurinoma and cavernous hemangioma. The correlation of the x-ray appearance with the operative findings is discussed in detail; the mucosa in the tumor area especially was studied explicitly. Myomas present an evenly rounded surface; the mucous membrane is generally intact and movable; only occasionally are large craters seen. In papilloma, the surface presents the typical "papillomatous" appearance, while hemangiomas present soft indentations with accumulations of phleboliths in the cavernous spaces. Studies further included the movability of the tumors in relation to the mucous membrane and the muscular wall and the compressibility of soft tumors, as well as peristaltic phenomena and the appearance of relief outlines in the neighboring mucosa.

The difficulty of definite differential diagnosis is stressed in the case of benign tumors with a tendency to malignant proliferation, especially papillomas and simple polyps. In some cases with malignant change not even the gross examination during and following operation raised the question of malignancy, and the later microscopic diagnosis was a surprise to both surgeons and roentgenologists.

The treatment of choice is surgical removal. Generally, gastric resection is considered preferable to simple tumor extirpation, at least in the case of papillomas. E. A. SCHMIDT, M.D.

Leiomyosarcoma Ventriculi: Three Cases. Olav Holta. Acta radiol. **24:** 166–173, April 30, 1943. (In English.)

Sarcomas of the stomach wall are relatively rare, accounting for only about 1 per cent of all gastric cancers. Three cases are reported by the author. Partial stomach resection was performed in all of these, and the diagnosis was established microscopically. In each instance roentgen examination had shown a sharply defined endogastric tumor of an appearance usually considered typical of a benign lesion. The clinical symptoms of leiomyosarcoma (dyspeptic discomfort, late vomiting and hemorrhage, pain immediately after meals or tardy "hunger pain") are not characteristic and point just as often to ulcer as to tumor invasion. According to Holta, x-ray examination cannot differentiate conclusively between sarcoma and other gastric neoplasms. Treatment is by radical surgery. If metastases are absent, the prognosis is relatively favorable following operation; freedom from symptoms for up to fourteen years has been reported. In the unoperated case, the average time of survival following onset of symptoms is three and a half years.
E. A. SCHMIDT, M.D.

Volvulus of the Stomach. Nils Frostberg. Acta radiol. **24:** 217–225, June 15, 1943. (In German.)

Volvulus of the stomach is rarely diagnosed before operation or autopsy. According to the extent of the volvulus, partial and complete types are differentiated. As far as the direction of the gastric rotation is concerned, the mesenterio-axial type (in which the stomach rotates about an axis formed by the lesser omentum and the body of the stomach) predominates over the organo-axial type (in which the stomach rotates on its longitudinal axis). With regard to etiology, five types have been described: (1) volvulus in diaphragmatic hernia, (2) volvulus in gastric ulcers, (3) volvulus in inflammatory processes, (4) volvulus in displacement of neighboring organs, and (5) idiopathic volvulus. In the differential diagnosis a number of other affections in the epigastrium must be considered, especially perforated ulcer, ileus, acute pancreatitis, and mesenteric embolus. In acute forms, stenosis of the cardia results, which prevents filling of the stomach by contrast medium. The treatment in acute cases is surgical; in chronic or partial cases without definite symptoms, no intervention is indicated.

The author describes a case of complete mesenterio-axial volvulus of the stomach in a 78-year-old woman. The diagnosis was made roentgenologically and confirmed by autopsy. At the same time, an adenocarcinoma of the stomach and marked ptosis of the spleen, combined with myeloid enlargement, were found, which factors probably contributed to the occurrence of the volvulus. E. A. SCHMIDT, M.D.

Case of Diverticulum in the Body of the Stomach. Herman Pedersen. Acta radiol. **24:** 311–316, Aug. 31, 1943. (In English.)

After a discussion of the pathogenesis of gastric diverticula, the author reports one the size of the closed fist, arising from the anterior wall of the stomach in a 72-year-old woman who had been asymptomatic up to

two months before the x-ray study and had since presented an ulcer-like syndrome. Surgical removal produced symptomatic relief. The diverticulum contained all three layers of the gastric wall and, since cicatricial changes were found around its neck and in the adjacent pyloric walls and sac, it was believed to be a result of scarring from gastric ulcer.

LEWIS G. JACOBS, M.D.

Immersion Blast Injury—Clinical Experiences. E. Lyle Gage. U. S. Nav. M. Bull. **44:** 225–231, February 1945.

Pathology of Immersion Blast Injury. Asher Yaguda. U. S. Nav. M. Bull. **44:** 232–240, February 1945.

Ninety-eight men survived a sinking at sea and subsequent depth charge explosion, following which they were in the water for nineteen hours and on the rescue boat seventeen hours before being hospitalized. Fourteen were in critical condition and 5 others were seriously injured. Nearly all suffered to some extent from exposure, sunburn, conjunctivitis, and fatigue. There was no evidence of injury to the genito-urinary tract, central nervous system, or ear drums in any of the group. Several suffered minor fractures. A number had evidence of injury of the chest (a pneumothorax with fractured ribs in one instance). Twenty-three suffered serious intra-abdominal injury and, of these, 4 died within the first forty-two hours and a fifth five days later. X-ray examination was made in 12 of the remaining cases and evidence of air in the peritoneal cavity was found in 4. Of the 18 survivors, 14 experienced nausea and vomiting and 11 had diarrhea; 3 passed blood by rectum.

Since all of these patients were received thirty-six hours after injury, conservative treatment was decided upon, with morphine given freely and no food or enemas until it could be definitely determined whether or not an intra-abdominal injury was present. Plasma, dextrose, or saline was given as indicated. Suction with the Miller-Abbott or Wangensteen tube was used in 10 cases. The cause of death of the first four patients was generalized peritonitis, and of the fifth, plasma anaphylaxis.

Detailed reports of four cases are given illustrating the diversity of response to immersion blast perforation of the bowel. Three cases required surgical interference. In two of these, this consisted in drainage of abscess cavities.

Careful questioning showed that all those with severe intra-abdominal injury were either lying on the abdomen in the water or were in water above the abdomen and facing the blast, which was estimated to to be within one hundred feet of them.

The important point of this article is the fact that so many recovered with conservative management despite serious intra-abdominal injury and a delay of thirty-six hours before effective therapy could be started.

The paper by Yaguda includes reports of the fatal cases with autopsy findings. He concludes: "From the findings described, it is seen that the damage resulting from immersion blast concussion is suffered chiefly by those organs which are normally air-containing and which are submerged at the time of the detonation. The intestine, therefore, being the most often submerged air-containing organ, bears the brunt of the injury. The lungs suffer relatively less severe injury and probably, when a sufficient number of autopsies are available for statistical study, will be found to be the chief cause of death in only a smaller percentage of immersion blast casualties. It is probable that the total injury in both the lungs and the intestines determines, in the first few hours after injury, whether the patient will die shortly or is capable of recovery."

BERNARD S. KALAYJIAN, M.D.

Present Status of Chronic Regional or Cicatrizing Enteritis. H. L. Bockus. J. A. M. A. **127:** 449–456, Feb. 24, 1945.

Inflammatory Lesions of the Small Intestine: Surgical Aspects. Henry W. Cave. J. A. M. A. **127:** 456–458, Feb. 24, 1945.

In six and three-quarter pages of text, tables, and illustrations, Bockus has presented an extremely well ordered and thoughtful exposition on a subject which all too often has been confused rather than clarified in medical writings. The factual knowledge regarding chronic enteritis has been catalogued. The incidence and the clinical and roentgenologic manifestations are presented.

Controversial features of regional enteritis, related largely to probable etiological factors, are discussed at some length. It seems possible, if not probable, that the characteristic abnormalities of the gut wall which have been described in examples of this disease depend for their inception upon some situation which produces blockage of lymph drainage.

Results obtained by means of radical resection of affected segments of the intestinal tract in the case of 19 patients are used to illustrate the efficacy of surgical methods of treatment. In 37 per cent of the group good results were obtained. Operative mortality for this particular group of patients reached 16 per cent. Medical management is based to a large extent upon the maintenance of adequate nutrition in the face of severe derangement of the processes of digestion. Protein deficiency must be overcome. The newer drugs, penicillin and the sulfonamides, have not as yet been spectacular in their effects. Roentgen therapy does not look to be promising in the control of ileitis. Spontaneous remissions of symptoms are known to occur. This fact should encourage both patient and physician.

Cave's paper deals with regional ileitis as a surgical problem. Twenty-three patients with regional ileitis were treated surgically by the author during a period of ten years. Whereas most surgeons recommend resection of visibly involved gut, together with a cuff of normal intestine, Garlock and his associates have reported highly gratifying results from ileocolostomy and exclusion of the diseased segment. Appendectomy, either early or late in the course of regional ileitis, "invites disaster."

FRED JENNER HODGES, M.D.
(University of Michigan)

Congenital Ileal Atresia with Gangrene, Perforation and Peritonitis in a Newborn Infant. Staged Operations: Obstructive Resection, Ileocolostomy and Excision of Exteriorized Ileum. Ernest E. Arnheim. Am. J. Dis. Child. **69:** 108–116, February 1945.

Congenital atresia of the ileum is characterized by the usual signs and symptoms of intestinal obstruction: persistent vomiting of bile-stained fluid and

increasing abdominal distention. Roentgen examination reveals distended loops of small bowel and, later, fluid levels. A barium meal is not only unnecessary, since the newborn infant swallows sufficient air to distend the bowel proximal to the obstruction, but may be dangerous because of possible aspiration of the vomitus.

The case described represents the twelfth cure reported in the literature and the second to be obtained after gangrene, perforation, and peritonitis had supervened. The patient was a female infant aged 26 hours. The operation devised by the author was performed in 3 stages under ether anesthesia. The first stage consisted of resection of the necrotic portion of the ileum proximal to the site of atresia and exteriorization of the proximal and distal loops of ileum. Sixty hours after the resection, a side-to-side, isoperistaltic ileo-transverse colostomy was accomplished. At this time both loops of the exteriorized ileum were opened by removing the silk sutures at the cut ends. Bronchiolitis developed on the 18th postoperative day but responded to oxygen and sulfathiazole therapy after one week. On the 44th postoperative day, a severe diarrhea began, continuing for four days. This responded to a transfusion of citrated blood and fluids given parenterally. The third stage, to remove the exteriorized ileum, was performed fourteen months after the second operation. On re-opening the abdomen, a second atresia was found in the course of the distal loop of ileum near the cecum. Follow-up examination at the age of 2 1/2 years showed the child to be apparently normal. Her weight was 29 pounds and height 36 inches. There was one normal stool a day, the abdomen was not distended, and the abdominal scars were firm.

The dietetic and general care of the patient, as well as the operative procedures, are described in minute detail. The article is well illustrated with sketches of the operation, photographs of the patient and operative specimens, and roentgen reproductions.

LESTER M. J. FREEDMAN, M.D.

Roentgenologic Diagnosis and Treatment of Intussusception in Children. Hans Hellmer. Acta radiol. **24:** 235–258, June 15, 1943. (In English.)

The author reports 110 cases of intussusception in children diagnosed roentgenologically during a period of nine and a half years at the Lund University Clinics. In all cases a barium enema was employed not only as a means of diagnosis but also with the intent to reduce the invagination under fluoroscopic control. This attempt at reduction was successful in 80 per cent of the cases (88 cases). In 51 cases, 30 of which were reduced by means of barium enema, the intussusception had started in the small intestine. In 7 cases the intussusception began in the colon, while in almost one-half of the cases (52) the site of origin could not be definitely ascertained.

Hellmer answers the objections raised by Obst (Ergebn. d. Chir. u. Orthop. **30:** 372, 1937) against attempts at non-operative reduction of intussusception. Unlike Obst, he thinks the method well applicable to cases of obstruction in the small intestine and does not consider the dangers (loss of time, obscuring of symptoms, etc.) important enough to prevent its use.

Narcosis was not necessary in any cases of roentgenologic diagnosis and reduction.

E. A. SCHMIDT, M.D.

Radiologic Picture of Acute Invagination of the Small Intestine in Children. Jens M. Nordentoft. Acta radiol. **24:** 469–477, Dec. 31, 1943. (In French.)

Small intestine intussusception in children is uncommon, constituting 5 to 8 per cent of all cases of intussusception; if only children under a year or two are considered, the percentage is still lower—2 to 3 per cent. Since its clinical diagnosis is difficult and it cannot be demonstrated by barium enema, it is desirable to consider the value of radiologic examination in this condition. While it is evident that a barium enema will not demonstrate small bowel intussusception, a plain film will show the presence of a marked obstruction and, at least at times, permit demonstration of an invagination of the ileum. In some cases, also, reflux from an opaque enema will show this. Careful fluoroscopic study during injection of the enema and after evacuation, with special attention to the ileocecal region, is important, because of the frequency of intussusceptions in this region; reduction may be accomplished by the examination. Five cases are recorded.

LEWIS G. JACOBS, M.D.

Value of the Barium Enema in the Diagnosis and Treatment of Intussusception in Children (Illustrated by About 500 Danish Cases). Jens M. Nordentoft. Acta radiol. **24:** 484–488, Dec. 31, 1943. (In English.)

This is a summary of the material presented by the author in Supplementum LI to *Acta Radiologica*. His study includes 440 cases of intussusception in children, in 202 of which barium enema studies were done.

Several types of intussusception are distinguished; in the small bowel, enteric and ileocolic; in the large bowel, colic and ileocecal. A combined form is common, and is often reduced by barium enema. This series included 128 small bowel types (18 definitely enteric), 293 large bowel types (16 colic and at least 7 or 8 haustral or haustrocecal).

In very young children the late passage of blood usually indicated intussusception of the small bowel type, which has a bad prognosis.

The roentgen diagnosis is based on fluoroscopic findings during the injection of the enema, but the preliminary film often gives a good deal of information in the distribution of the gas shadows.

In treatment, emphasis is laid on the importance of correct pressure, up to two meters of barium column, and on repeated injections; manipulations through the abdomen are less important. Anesthesia is to be avoided. The criteria of reduction consist of complete filling of the cecum and reflux into the small bowel. Secondary operation on cases erroneously believed reduced carries considerable danger. In children under two years of age, the enema treatment is distinctly superior; in older children it is a satisfactory method, although its advantages are less clearly marked.

LEWIS G. JACOBS, M.D.

Acute Obstruction of the Colon. Differential Diagnosis Between Volvulus and Cancer of the Sigmoid Colon by Preliminary Roentgenogram. Joseph Levitin and Helen B. Weyrauch. Am. J. Roentgenol. **53:** 132–141, February 1945.

The differential diagnosis between a slowly developing mechanical obstruction of the colon due to cancer of the sigmoid and that due to volvulus can be made at times from a plain roentgenogram of the abdomen.

Nine cases, including both types, are reported. In the presence of a cancer, since the obstruction is a slowly developing one, the colon accommodates itself by distending first in its thinnest part, the cecum. Later complete and relatively acute obstruction may supervene. The gas-distended colon can be visualized down to the point of obstruction, where a sharp interruption occurs. No large gas-filled loops are seen rising out of the pelvis. Volvulus of the sigmoid is caused by a sudden twisting of the sigmoid loop, so that it becomes a closed obstruction in relation to the rest of the bowel. The closed loop is rapidly distended with gas, rising out of the pelvis and occupying the middle of the abdomen. It may extend to the diaphragm. The volvulus may act as a mechanical block, resulting in dilatation of the colon proximal to it. The roentgen diagnosis depends upon the demonstration of this dilated loop of sigmoid.

L. W. PAUL, M.D.

Roentgenological Manifestations of Malignancy of the Colon. Lawther J. Whitehead. South. M. J. **38:** 85–88, February 1945.

This is a short general discussion of roentgenologic criteria in malignant neoplasms of the colon. The author points out that there are 30,000 deaths from cancer of the colon or rectum yearly and quotes the statement of Case that at least 90 per cent of cases should be correctly diagnosed. This, however, requires experience and skill, patience, and dexterity. Rectosigmoidoscopy should precede roentgen examination and a report of the findings should be available to the roentgenologist in every instance. Many spot films should be taken in special positions. Double contrast films are desirable. Re-examination and confirmatory studies should be freely undertaken to reduce the chances of error. Malignant lesions of the colon are often multiple, as in cancer originating in polyps.

MAX MASS, M.D.

Cholelithiasis in Sickle Cell Anemia. H. Stephen Weens. Ann. Int. Med. **22:** 182–191, February 1945.

Cholelithiasis is not infrequently observed in Negroes with sickle-cell anemia. Four cases of the latter condition in which gallstones were demonstrable roentgenologically are reported here.

The number of recorded cases of sickle-cell anemia coming to autopsy is comparatively small. The author found 44 fairly complete necropsy reports, and in 12 of the group gallstones were found postmortem or were removed surgically during the course of the disease. In none of the patients over forty were calculi observed. Anemia was not a characteristic feature of these latter cases, and it seems likely that they represented the so-called "sickle-cell trait." Eight of the 12 patients in whom cholelithiasis was observed were males.

Increased destruction of red blood cells is one of the characteristic features of sickle-cell anemia. On disintegration of the red blood corpuscles, hemoglobin is liberated and converted into bilirubin. Hyperbilirubinemia in these patients is the result of increased blood destruction. This phenomenon is common to both sickle-cell anemia and congenital hemolytic jaundice, in which latter condition Mayo observed the presence of cholelithiasis in two-thirds of a group of patients.

With the generally lower incidence of gallstones in the colored race, sickle-cell anemia may be a more important etiologic factor in the development of biliary calculi in the Negro than is generally appreciated.

Episodes of acute abdominal pain, usually localized in the epigastrium, occur frequently in sickle-cell anemia. As yet, the cause of these abdominal crises has not been satisfactorily explained. Hepatic infarcts, splenic hemorrhages, and nerve root pains due to vertebral changes have been suggested. That the crises are to be explained on the basis of biliary colic seems unlikely, since many patients with sickle-cell anemia do not have cholelithiasis, and in other cases the attacks have been known to continue after cholecystectomy.

Recognition of sickle-cell anemia as a cause of acute and chronic abdominal symptoms is important in order to avoid unnecessary operations. The mere presence of biliary calculi in a patient with sickle-cell anemia requires careful evaluation of all clinical symptoms before operation is advised, since it is commonly known that this disease increases the risk of surgical procedures.

STEPHEN N. TAGER, M.D.

Nursing: A Source of Error in Cholecystography. Olle Olsson. Acta radiol. **24:** 489–494, Dec. 31, 1943. (In German.)

The author calls attention to a source of error in cholecystography with sodium tetraiodophenolphthalein. This dye is excreted in the milk of nursing mothers, reducing the amount of dye in the blood below the level necessary for demonstration of the gallbladder. A case is reported in which non-visualization was present during the nursing period, although both before and after this visualization was normal, and no change of symptoms had occurred. A second case is reported in which two attempts to visualize the gallbladder failed during lactation, but at operation, four days following the second examination, the gallbladder, liver, and pancreas were found to be normal.

LEWIS G. JACOBS, M.D.

Meckel's Diverticulum. M. E. Mottram and L. H. Garland. Am. J. Roentgenol. **53:** 142–146, February 1945.

Meckel's diverticulum is an unobliterated remnant of the vitelline duct and is found in approximately 2 per cent of the population. It may vary a great deal in size, shape, and location. While anatomists describe it as arising from the terminal ileum, surgeons frequently find it at a much higher level, suggesting that the higher its location in the small intestine, the more likely is the possibility of surgical complication. The diverticulum may have walls identical in structure with those of the adjacent bowel, or one of the muscle layers may be absent. Heterotopic gastric or duodenal glands may be present.

Roentgen diagnosis of the smaller sacs (2.5 cm. in diameter) is rarely possible. Only about 21 cases have been reported in the literature as being correctly diagnosed prior to operation. In the case reported by the authors, roentgen study following a barium meal demonstrated a circular collection or pocket of the medium in the mid-abdominal area, about 5 × 9 cm. in size. The sac retained some barium for over twenty-four hours. At operation it was found 60 cm. from the ileocecal valve. Roentgen diagnosis of the larger sacs should be possible on careful gastro-intestinal examination.

L. W. PAUL, M.D.

THE MUSCULOSKELETAL SYSTEM

Degree of Kinship and Pattern of Ossification. A Longitudinal X-Ray Study of the Appearance Pattern of Ossification Centers in Children of Different Kinship Groups. Earle L. Reynolds. Am. J. Phys. Anthropol. 1: 405–416, December 1943.

The study here recorded was made to determine whether the patterns of appearance of skeletal epiphyses are more similar in related than in unrelated children. It is also concerned with the degree of kinship, attempting to show whether identical twins, for example, are more similar in patterns of ossification than are ordinary siblings or first cousins. Onset of ossification is defined as the estimated time at which an ossification center appears, as judged by its first visible shadow on the x-ray plate. The 38 centers chosen for this study were selected so as to be representative both anatomically and in time of appearance from birth to around 78 months. Four kinship groups were observed: identical twins (6 pairs), siblings (22 pairs), first cousins (8 pairs), unrelated children (9 pairs).

It was found that pairs of more closely related children tend to have onset patterns that are more similar; deviant centers which are more similar in time of onset to their corresponding centers; subgroups of ossification centers which are more similar in order of appearance. The ranking from greatest to least similarity in each instance was: twins, siblings, cousins, unrelated children.

This consistent hierarchy of resemblance points to some selective factor operating within the kinship groups. It is suggested that this selective factor is heredity operating upon both time and order of onset of ossification centers in the body.

Ossification Sequences in Identical Triplets. A Longitudinal Study of Resemblances and Differences in the Ossification Patterns of a Set of Monozygotic Triplets. Lester W. Sontag and Earle L. Reynolds. J. Heredity **35:** 57–64, February 1944.

A study was made of the patterns of ossification in a set of monozygotic triplets whose external environment had been apparently quite similar and whose illness history during the period covered by the present study, with the exception of two isolated colds, had been the same.

Roentgenograms were taken at six-month intervals from the age of twenty-four months to fourteen and a half years. The patterns of onset of ossification of the 26 centers, selected on basis of availability, although very similar, nevertheless showed a number of differences. The rates of skeletal progress of these triplets changed so that their rank-order of onset of ossification centers was different at different ages. The greatest variation of time of onset was in the appearance of the centers for the metatarsals. The triplet who led in onset time for the majority of the other centers, particularly in the hand phalanges, was later than his brothers in the onset time of all the carpals studied. The triplet showing the least number of ossification centers present from 36 through 54 months passed his brothers in this respect at 60 through 72 months of age.

The authors conclude that certain environmental factors or acquired metabolic characteristics may be capable of modifying the genetic pattern of ossification.

Aseptic Necrosis of the Capital Femoral Epiphysis Following Adolescent Epiphyseolysis. Robert D. Moore. Surg., Gynec. & Obst. **80:** 199–204, February 1945.

This article is a report of the gross and microscopic pathology in two cases of slipped femoral epiphysis and a review of the literature on similar reported cases.

The first patient was a 12-year-old boy who had a portion of the femoral head excised following avascular necrosis in a slipped epiphysis. The specimen demonstrated narrowing of the articular cartilage due to degeneration and endochondral ossification from below as the blood supply returned. Chronic inflammatory changes were present in the synovia.

The second patient was a 21-year-old male with non-union after complete separation of the right femoral capital epiphysis. The head was excised and an arthrodesis performed. The articular cartilage was largely necrotic and replaced by connective tissue from below and by fibrocartilaginous tissue and pannus from above. Only a small amount of the necrotic bone had been replaced by new bone. There were degenerative changes in the opposing acetabular articular cartilage.

The author points out that during the early growing period the articular cartilage is less dependent upon the circulation from the underlying bone and the synovia may furnish adequate circulation, so that in Legg-Perthes' disease, when endochondral bone ossification is resumed, the shadow of the articular cartilage, as seen in the roentgenogram, remains thickened. In slipped femoral epiphysis in the young adolescent, however, since growth is slower, much of the deeper zone of cartilage undergoes degeneration followed by endochondral bone replacement with a resultant actual decrease in thickness of the cartilage. In the first case there was considerable new bone formation in the area of necrotic bone; in the second case there was little.

The chronic inflammatory changes in the synovia, the author believes, are the result of mechanical derangement or decomposition products of necrotic bone and cartilage.

The paper is well illustrated.

FRANK P. BROOKS, M.D.

Aseptic Necrosis of the Epiphyses and Short Bones. Roentgen Studies. Howard P. Doub. J. A. M. A. **127:** 311–317, Feb. 10, 1945.

The findings in aseptic necrosis as it involves the developing epiphyses and the primary centers of ossification in certain of the short bones are discussed. Short descriptions are given of the salient points of some of the more commonly observed lesions.

No general agreement has been reached as to the etiology of aseptic necrosis. That some form of trauma with secondary vascular occlusion of the involved area is responsible is held by many. Embolic occlusion has also been mentioned as a cause, and endocrine dysfunction has been invoked by others.

The pathologic process probably involves actual death of the ossifying nucleus, followed by fragmentation, irregular absorption of the involved bone, and replacement by so-called creeping substitution or recalcification. This is the same process that has been observed in adults, in whom aseptic necrosis is being increasingly recognized. The cartilage is in most instances not involved in the process. In general, the clinical findings are not prominent or acute, and there

may be no complaint except for slight pain and limping. There may be restriction of motion of the involved part.

The roentgen examination has been of the greatest aid in the study of the changing pathologic picture in these cases. In the earliest stages there are usually small areas of lessened density which, under observation, increase in extent and intensity. The epiphysis becomes fissured and fragmented and fuzzy in outline, with a ragged appearance. Areas of dense necrotic bone are visualized. The process may involve both the epiphysis and the metaphysis, and the former may be compressed and flattened. In the stage of regeneration or recovery there is a gradual loss of the osteoporosis with absorption of the dense necrotic bone in the epiphysis. This is followed by slowly advancing replacement of the necrotic bone by recalcification, which proceeds until there is complete bony restitution.

The amount of deformity of the restored bony contour depends on many factors, including the stage at which the condition was first recognized and adequate treatment applied. The duration of treatment also plays a role. Some patients refuse to allow the involved part adequate rest after the symptoms have disappeared. It should be recognized that there is a definite lag in bony replacement as compared with the disappearance of symptoms. Many patients have a definite sense of well-being at a time when the roentgenograms still show necrosis and very little evidence of regeneration.

Roentgenological Early Symptoms and Healing Phenomena in Chronic Rheumatic Arthritis. Folke Knutsson. Acta radiol. **24:** 121–134, April 30, 1943. (In English.)

Articular decalcification is described as an initial roentgenologic symptom of chronic rheumatic arthritis. Another early manifestation is juxta-articular periostitis. This, Knutsson says, he has not found mentioned in the literature, and to our knowledge he is the first to describe it. The earliest roentgenological changes are, as a rule, noticed in the bones of the hands and feet. The proximal point of the little toe is a favorite site. The subsequent development is characterized by destruction of cartilage, leading to diminution of the joint space, and by ulceration. If healing occurs, the ragged contours produced by ulceration disappear and an even bone outline ensues. The destructive type of arthritis is thus transformed to a deforming type. Another healing process results in osseous ankylosis in consequence of total destruction of cartilage.

E. A. SCHMIDT, M.D.

Report of Injuries Among Survivors of an Airplane Crash. John S. Thiemeyer, Jr. U. S. Nav. M. Bull. **44:** 241–246, February 1945.

Fifteen of 29 persons survived an airplane crash at sea. They were rescued after twenty-three hours on life rafts; one died seven hours later, and the remainder reached a hospital three days after the crash. Eleven of these had sustained 22 fractures, involving the cervical and thoracic vertebrae, ribs, humerus, scapula, clavicle, radius, fibula, metatarsals, and mandible. Careful study of the fracture lines and the mechanics of production of the fractures indicated that they were due to counteracting muscle pull upon the bones rather than to direct trauma. This was particularly true of fractures of the humerus and scapula. The author points out the need for repeated x-ray studies when fractures of the vertebrae are suspected.

BERNARD S. KALAYJIAN, M.D.

Diagnosis of Fracture of the Ribs, Scapula, Sternum and Mandible. James W. Lewis. Mil. Surgeon **96:** 175–177, February 1945.

In roentgenography of the ribs or other parts having overlying, interfering structures, the author has found that better detail will be obtained by the use of a short focal-film distance. For the ribs, for example, the film is placed as close to the particular region to be demonstrated as possible, eliminating the Bucky diaphragm. The tube is then placed close to the opposite side of the body, touching it if the equipment permits. If feasible, an immobilization band is drawn tightly across the chest. When the posterior ribs are being examined, the patient is instructed to breathe normally, as the motion of breathing moves, and thus blurs, the anterior ribs and lung tissue. With the chest immobilized and with the patient supine, the posterior ribs will be practically motionless. When the anterior ribs are being studied, the patient must stop breathing. With such a short focal-film distance, the image of the ribs tends to be distorted. This may be compensated for to some extent by means of a very small focal spot. Since the Bucky diaphragm is not used, a comparatively low voltage (38 to 42 kv.p. is optimum for the ribs) is necessary to improve the contrast of the film. This method is successful for ribs above the diaphragm only.

Examination of the mandible is simple and should require only a few minutes. The patient sits upright, with his head in normal position, and holds the film lightly against the cheek. Since the tube must be brought close to the opposite cheek, it is obvious that a cone cannot be used. To overcome this difficulty, a diaphragm has been constructed which is placed in the cone slot. The diaphragm may be made from a piece of thin lead by cutting a hole just large enough to permit the ray to cover the desired area at a set distance—the distance from the focal spot to the film. The optimum voltage is 50 kv.p.

For the short focal-film method, the part to be demonstrated must be close to the film and the part to be blurred close to the focal spot, with the two parts at some distance from each other. A small focal spot and a very low voltage must be employed.

Investigation of Sciatica and Lumbago—Radiological Aspect. James F. Brailsford. Brit. J. Radiol. **17:** 308–311, October 1944.

The evaluation of evidence in the investigation of low-back pain is one of the most difficult of clinical tasks. The causes are many and variable, including maldevelopment, injury, inflammation, and new growths in the skeletal, nervous, gastro-intestinal, vascular, and genito-urinary systems. Thorough investigation of all possible sources is essential before any major surgical procedure is undertaken.

The present paper is concerned primarily with the value of radiology in actual lumbosacral lesions. Only a small proportion of patients with low-back pain have lesions in the lumbosacral region demonstrable in the early stages by x-ray. This, however, does not justify the omission of roentgenography, as many lesions of

grave importance are first revealed through that agency. In certain recurrent cases, the primary examination may be negative, while subsequent studies show lipping of the borders of the vertebrae or articular facets, indicating that an inflammatory process has been going on.

Irregularities of development in the lumbosacral region are common and are frequently discovered in examinations of the urinary and digestive tracts. These are usually unassociated with symptoms but may later give rise to difficulties. Thus, asymmetrical development of the body or transverse processes of the fifth lumbar vertebra, or of the lateral mass of the first sacral vertebra, though usually asymptomatic in adolescence, may become troublesome with the strains of adult life.

Hypoplasia of the neural arch of the fifth lumbar vertebra and failure of fusion of the elements between the articular processes are sometimes seen in association with spondylolisthesis. The latter condition occurs frequently in young women, in whom it may seriously interfere with parturition.

Some lumbosacral lesions are associated with generalized bone disease, as rickets, Paget's disease and hyperparathyroidism. In such cases the upper segments of the sacrum may become almost horizontal and the lower segments flexed, resulting in a lordosis.

The lumbosacral area is prone to injury in falls, crushes, and lifting of weights. The results of these injuries may show no evidence on x-ray examination, as many are muscular and ligamentous. With severe degrees of trauma to the bones or ligaments, though no change can be detected by roentgenography during the first few weeks, later reactive changes are demonstrable—some degree of localized osteoporosis, followed after two or three months by ossification of the ligaments.

Sometimes pre-existing diseases such as tuberculous caries, syphilitic gummata, and bone tumors are first seen after trauma, having been previously symptomless.

Lesions of the intervertebral disks may be recognized in the plain roentgenogram by calcium deposits, by narrowing of the intervertebral space, and by certain deformities in the vertebral bodies, while protrusions from the disk into the spinal canal can be detected only with the aid of lipiodol or other contrast medium. The author warns against indiscriminate surgery in disk lesions.

SYDNEY J. HAWLEY, M.D.

Anatomical Investigations on the Distribution of Epidural Fat in the Lumbar Spine: Contribution to Myelographic Differential Diagnosis. Helge Sjövall. Acta radiol. **24:** 177–182, June 15, 1943. (In German.)

The purpose of the author's investigations was to determine whether or not the presence and distribution of epidural fat might be a confusing factor in the diagnosis of prolapse of the intervertebral disks. Postmortem examination of 25 lumbar spines showed (1) abundant fat accumulation segmentally arranged in the posterior areas; (2) some fat coating in lateral distribution; (3) no fat in the ventral epidural space from the 4th intervertebral disk upward and only a poorly developed microscopic fat layer ventrally at the height of the 5th intervertebral disk. Only in this latter area may epidural fat interfere with the myelographic diagnosis of prolapse of the intervertebral disk.

E. A. SCHMIDT, M.D.

Should Non-Traumatic and Non-Inflammatory Changes in the Spine Be Compensable? John D. Ellis. Am. J. Surg. **67:** 391–400, February 1945.

The present tendency to award compensation for total permanent disability to older workmen who claim an aggravation of ancient hypertrophic changes about the spine and spinal joints presents one of the commonest abuses of our legal system. There are two reasons for this. The first is the confusion of terminology inherent in the discussion of degenerative and inflammatory conditions, with no strict differentiation in texts on pathology between the invasion of tissues by infecting organisms and tissue changes resulting from mechanical trauma. The second arises out of the very nature of present-day legal procedures. Nothing fits in so well with our system of cross-examination as an attack by the examiner on a subject concerning which the terminology is confused. The surgeon is unable to explain clearly to a lay jury what pathological conditions are traumatic or influenced by trauma and what is perhaps degenerative or hypertrophic, reconstructive or functional, and wholly unaffected by trauma.

Chronic affections of the joints have been divided into two great groups (1) rheumatoid arthritis, atrophic arthritis, infective arthritis, etc., and (2) osteoarthritis, hypertrophic or degenerative arthritis, etc. This paper is concerned with the conditions falling in the latter group. Physicians interested in the role played by trauma must definitely disregard any such prevalent terms as osteoarthritis, degenerative arthritis, and hypertrophic arthritis in the description of diseases which are not inflammatory in nature. The author believes that the nomenclature accepted in all continental medical literature should be employed, using "arthrosis" to emphasize the non-inflammatory nature of hypertrophic and osteoarthritis and "spondylosis" in preference to spondylitis for all non-inflammatory or degenerative affections of the vertebral bodies themselves. The chronic nature of these conditions can be determined with certainty by systematic physical and roentgenological examinations.

Roentgenographic Demonstration by Tantalum Powder of Sinuses Resulting from Extraction of Intervertebral Disc Protrusions. Carl J. Graf and Wallace B. Hamby. Am. J. Roentgenol. **53:** 157–160, February 1945.

In order to demonstrate the sinuses that remain following removal of protrusions of the lumbar intervertebral disks, the authors have employed tantalum powder. At the time of operation a curette cup full of the powder (double this amount is now used) is introduced into the disk sinus. Roentgenograms made postoperatively show the sinus as an elongated slit extending toward and in some cases to the anterior part of the annulus fibrosus. Follow-up roentgenograms after as long an interval as seven months have shown no significant alteration in the appearance. Histopathologic study in one case, six weeks after implantation of the powder, showed only mild reactive changes.

L. W. PAUL, M.D.

"Os Acetabuli" and Other Bone Nuclei; Periarticular Calcifications at the Hip-Joint. Göran Zander. Acta radiol. **24:** 317–327, Aug. 31, 1943. (In English.)

The author points out that, strictly speaking, the term os acetabuli is synonymous with os cotyloideum

and os coxae quartum, representing the ossification center in the Y-shaped cartilage of the acetabulum which appears at puberty and fuses the pelvis into a single bone. Since the term has this well accepted significance in comparative anatomy and phylogeny, its use should be confined to this meaning. The nucleus observed roentgenologically at the upper rim of the acetabulum is probably not identical with the anatomical os acetabuli, although there is some dispute as to this matter. The name os marginalis superior acetabuli is proposed for this "roentgenologic os acetabuli." It usually fuses with the pelvis at the age of thirty.

Calcifications of other origin may occur about the hip joint and be confused with the os acetabuli. A round sesamoid is sometimes found in the insertion of the oblique tendon of the rectus femoris. Its round shape and thin, well defined cortex should identify it. It is occasionally split into several segments. Calcification in the joint capsule and bone formation in tendon insertions may be confusing; peritendinous calcifications similar to those found in the shoulder are a frequent source of error, but may be distinguished by their amorphous structure and tendency to disappear with or without treatment. These may also appear in relation to the trochanters. Careful technic, both as to the density of the films and positioning, is required for an accurate diagnosis of these conditions.

LEWIS G. JACOBS, M.D.

Oblique Projection for Roentgen Examination of the Talo-Calcanean Joint, Particularly Regarding Intra-Articular Fracture of the Calcaneus. W. Anthonsen. Acta radiol. **24:** 306–310, Aug. 31, 1943. (In English.)

In intra-articular fracture of the calcaneus, accurate appraisal of the damage is necessary to decide whether or not a subtalar arthrodesis is required. While lateral projections are of great importance, they are not sufficient for this purpose. An oblique projection is needed to determine the status of the posterior articular face of this bone. The technic is described as follows, "The foot is placed in dorsal flexion with its lateral side toward the film. The central ray is directed against a point just below the malleolus medialis with an inclination of 25° in craniodistal direction and 30° in dorsoventral direction; the distance of the focus is reduced to 25 to 35 cm." With this projection the posterior talocalcaneal joint is clearly demonstrated for evaluation of injury or arthritic change.

LEWIS G. JACOBS, M.D.

Periosteal Lesions in Scurvy. William A. Evans, Jr. Am. J. Roentgenol. **53:** 147–156, February 1945.

It is a prevalent misconception that periosteal lesions are a prominent feature of the diagnosis and pathology of scurvy. Actually subperiosteal hemorrhages are a late manifestation, the earliest osseous changes occurring in the metaphyses.

Scurvy is by no means a rare disease. During a six-year period, 1936–1941, 93 cases were so diagnosed in a children's hospital service comprising 106,800 new outpatient visits and 41,773 hospital admissions. The disease was found almost exclusively in the age period seven to thirteen months inclusive. The earliest changes in this group of cases were manifested by a ground-glass type of demineralization of the bone structure and by a signet-ring appearance of the epiphyses. This latter change was most pronounced at the knee joints. The submetaphyseal notch described by Park and his colleagues (Arch. Dis. Childhood **10:** 265, 1935) was found in 89 per cent of the 93 cases. The metaphysis was fragmented or separated in 42 cases. Two types of periosteal shadows were encountered. Type I appeared as a narrow triangular shadow having its base at the metaphysis and extending some distance along the shaft. This was seen only when there was some fragmentation of the metaphysis with a slight lateral displacement of a small marginal fragment. The Type II periosteal shadow was much larger, usually club-shaped, extending along the greater length of the shaft. It was quite constantly associated with displacement of a large portion of the metaphysis and the epiphysis. In differential diagnosis the following need to be considered:

Rickets: Rachitic changes are apt to be most pronounced in the distal ulnar metaphysis, and the periosteal shadows tend to occur in the mid-shafts and to be laminated. They are most pronounced in the first six months of life and are less frequently seen during the age period when scurvy is prone to occur.

Infection: Differentiation of scurvy from the various infections ordinarily is not difficult. It is based upon the character and location of the periosteal shadows, the destructive lesion in the bone itself, and the absence of scorbutic changes in the metaphyses.

Trauma: Traumatic displacement of an epiphysis results in subperiosteal hemorrhages not unlike those seen in scurvy. These are usually the result of birth trauma and are uncommon in the lower femur, where scorbutic changes are the most frequent.

Neoplasm: Neoplastic infiltration, especially that of leukemia and neuroblastoma, may resemble scurvy to some degree. In these lesions, however, the subperiosteal changes tend to occur in the mid-shaft areas and there usually is recognizable destruction in the underlying bone.

L. W. PAUL, M.D.

Calcareous Peritendinitis: Two Cases with Localization to the Fingers. Knud F. Jansen. Acta radiol. **24:** 285–288, Aug. 31, 1943. (In English.)

Two cases of calcareous peritendinitis localized to the finger tendons are recorded. The calcifications disappeared after application of heat in one case and roentgen therapy in the other. While the etiology of this condition is obscure, the author feels that some chronic occupational trauma was responsible, since both patients were household workers.

LEWIS G. JACOBS, M.D.

Syndrome of Trauma to the Psoas Muscle. Elliott Michelson. Arch. Surg. **50:** 77–81, February 1945.

Injuries to the psoas muscle are rare but occasionally occur as a result of indirect trauma. They produce sudden acute pain, often accompanied by a knocking sound, followed by an asymptomatic latent period. Later, after an hour to a few days, pain and disability recur; the patient walks with a limp and has difficulty bending the affected leg. Examination shows flexion contracture of the thigh with adduction and external rotation, and apparent shortening of the extremity. There is a scoliosis of the lumbar spine away from the affected side. A mass or fullness is found in the flank, groin, abdomen, or iliac fossa. A normal psoas outline is seen on the roentgenogram, but there is lateral deviation of the lower pole of the kidney and of the upper ureter, a sign first described in

this article. Large hemorrhagic extravasations lead to nerve irritation, which disappears following adequate drainage. Complications include cyst formation, calcification, and infection. Occasionally an abscess so formed may penetrate into neighboring structures. Early operation leads to complete recovery.

An illustrative case is reported, in a soldier who sustained the injury in diving, subsequently developed an abscess, and was cured by operation. Pyelograms showing the renal displacement are reproduced.

LEWIS G. JACOBS, M.D.

THE SPINAL CORD

Two Cases of Morvan's Syndrome of Uncertain Cause. Harry Parks and O. S. Staples. Arch. Int. Med. **75:** 75–81, February 1945.

Two cases of Morvan's syndrome are reported and 7 cases, which were all that the authors could find recorded in the literature as occurring in children, are briefly reviewed.

This disease appears to develop in young people of either sex. The first symptoms are sensory, consisting usually of absence of pain following burns or other injuries. Later there develops loss of the sensation of pain, temperature, and usually touch in the distal parts of all four extremities. Trophic changes soon become prominent in the form of ulcers, atrophy of the bones, and changes in the nails; spontaneous amputation of small parts may become necessary because of infection. The superficial and deep tendon reflexes may be absent, diminished, or normal. There is no paralysis, muscular weakness, or atrophy, and evidence of involvement of the upper motor neurons and of the lateral or pyramidal tract is strikingly absent. The syndrome may resemble certain forms of syringomyelia but lacks the characteristic segmental distribution of dissociated sensation which is ordinarily found in that disease. The course of Morvan's syndrome is relatively benign.

Roentgenograms in the authors' cases are reproduced. They reveal as an early lesion loss of tufting of the terminal phalanges in the hands and feet.

GYNECOLOGY AND OBSTETRICS

Use of a New Contrast Medium (Visco-Rayopake) in the Female Generative Tract. W. B. Norment. Am. J. Obst. & Gynec. **49:** 253–260, February 1945.

The author outlines the objectionable features of the radiopaque iodized oils used in hysterography and lists Rubin's prerequisites for an ideal radiopaque contrast medium (New York State J. Med **36:** 1089, 1936): (1) adequate radiopacity, (2) rapid absorbability, (3) freedom from chemical irritation, (4) proper viscosity. Visco-Rayopake, or 2,4-dioxo-3-iodo-6-methyl tetra hydropyridine acetic acid, one of the more recently marketed radiopaque contrast media, is said to closely approximate this ideal.

This non-oily organic iodine compound was used in 20 cases and in the author's opinion meets Rubin's prerequisites better than any of the usual radiopaque media. He describes the usual methods of employing the contrast medium. In the previously curetted uterus he has found the insertion of a medium de Pezzer catheter through the cervical canal more satisfactory than a cannula. He also suggests the insertion of a small balloon in large uterine cavities. The contrast medium is instilled into the balloon, and tumors are recognized by its depression. This procedure is performed under general anesthesia.

Five case reports illustrate the already well known value of hysterosalpingography.

[*Abstractor's Note:* It has been the personal experience of the abstractor that Visco-Rayopaque, while having the advantages of more rapid absorbability and better viscosity, does not have the radiopacity of the iodized oils. It is less easily visualized by fluoroscopy (the usual procedure carried out during the instillation of these substances) and it produces as much irritation and discomfort in the patient as the oily preparations. It does offer the advantage of being more miscible with body secretions, thus permitting an even distribution without droplets or beads forming in the fallopian tubes as commonly occurs with the iodized oils.] STANLEY MACHT, M.D.

"Lipiodol" Pulmonary Emboli Following Hysterosalpingography. Melvin A. Roblee and Sherwood Moore. South. M. J. **38:** 89–94, February 1945.

The authors' patient was a 33-year-old woman with a history of two cesarean sections, the second followed by partial tubal resection and ligation. Hysterosalpingography was done seven years after the latter procedure. As the injection of lipiodol was about completed, the patient complained of pain, and the pulse and respiration were accelerated, but without other evidence of shock. Inspection of the first film, some five minutes later, showed filling not only of the uterus but of the pelvic veins as well, while in a chest film made after an interval of fifteen minutes the entire bronchovascular tree was delineated. The patient was hospitalized for one day, during which time moist râles in the bases of both lungs, laked red blood cells in the urine, and an icteric index of 15, indicating some hemolysis of the red cells, were observed. On the day following the injection the abdominal film showed practically no lipiodol, but oil was still evident in decreased amounts in a chest film made three days after this. On the fifth day some blood clots were expectorated and a roentgenogram revealed evidence of a localized pulmonary embolism, later disproved. By the twelfth day little or no residual lipiodol was demonstrable.

The authors cite other instances of accidental injection of lipiodol into the utero-ovarian veins during hysterosalpingography without untoward results. Of 7 cases reported by Lin and Tsou (Chinese M. J. **49:** 1241, 1935), 3 showed symptoms of mild "lipiodol" pulmonary embolism and 2 hemorrhagic infarction of the lungs with blood-tinged sputum. A number of serious accidents incident to insufflation and hysterosalpingography are also mentioned (Dible *et al.:* Lancet **1:** 313, 1938). [The case recorded by Eisen and Goldstein in the present issue of RADIOLOGY (p. 603) is of interest.—ED.]

The possible causes of venous intravasation in the course of hysterosalpingography are quoted from Williams (Brit. J. Radiol. **17:** 13, 1944. Abst. in Radiology **43:** 418, 1944): trauma by the cervical cannula; excessive pressure; injection when the endometrium is physiologically deficient, during or shortly after menstruation; recent surgical trauma to the endometrium and cervix. In the case recorded the cesarean scar or tubal sterilization scar is believed to have separated at the time of injection.

The paper concludes with the statement that if intravenous injection occurs, no more oil should be injected at any time, repeated films of the lungs should be made until all the oil is gone, and expectant treatment should be given, with forcing of fluids.

MAX MASS, M.D.

Thoracopagus Twins—X-Ray Diagnosis. Edward A. Graber. Am. J. Obst. & Gynec. **49:** 276–279, February 1945.

A case of thoracopagus twins is reported. The diagnosis was not made until failure of delivery after hard labor forced an exploration of the vagina and uterus. A destructive operation was performed on the fetus after several unsuccessful attempts to deliver it.

Although an antepartum diagnosis of twins was made by x-ray, the abnormality was not suggested. The author feels that had thoracopagus twins been considered when the roentgen studies were made, certain features on the films might have suggested an antepartum diagnosis. These were as follows:

1. The heads were at the same level. In almost all cases of twins, the heads are at different levels.
2. The head of one of the twins did not face to the front, but was turned to the side. This indicated that the babies were so close together that they could not face each other.
3. The hand of one baby was over the shoulder of the other and the arm of one was around the body of the other. This could have indicated that the babies were in the same amniotic sac.

The advantages of an antepartum diagnosis are obvious.

STANLEY MACHT, M.D.

THE GENITO-URINARY SYSTEM

Notes Regarding Intravenous Urograms, Based on 2,000 Series in Eighteen Years. Walter Pritchard. J. Urol. **53:** 387–392, February 1945.

Any patient whose vein can be entered, who is producing a fair amount of urine, and whose systolic blood pressure is over 80, is considered a suitable candidate for excretion urography. Preparation consists in dehydration by abstinence from fluid for eighteen hours and omission of breakfast. Purgation and enemas are not helpful.

The author considers the "standard" dosage of dye inadequate and gives double or treble that amount. Since the useful portion of the dye is iodine, the injection should be measured in grams of iodine rather than cubic centimeters of dye. The 20-c.c. ampule of 35 per cent diodrast contains approximately 7 gm. of iodine; 30 c.c. of 50 per cent neo-iopax contains twice as much. The amount of dye injected is proportionate to the patient's weight, age, and concentrating power. Children up to puberty advantageously handle twice as much iodine as adults per weight proportion; infants, three times as much. The poorer the patient's renal function, the more iodine he must have to produce satisfactory urograms. The author measures the specific gravity of a concentrated urine specimen to estimate renal function prior to urography. Poorly concentrating kidneys may yield a satisfactory urogram if there is at least 25 gm. of iodine in the blood. Ideal density requires 4 per cent iodine in the urine. The only disadvantage of moderate overdosage of dye is expense. When one is dealing with a nearly occlusive ureteral stone, excellent urograms are obtained hours after injection.

In order to obtain a peak plateau of concentration, the author injects the dye within one to two minutes. The forearm is preheated to induce hyperemia which will dilute the dye rapidly and decrease pain and intimal damage. Vein cramp warns of the latter hazard.

The higher concentration dyes, unless injected very slowly, produce more vein cramp and thrombosis. The patient often has aching extending to the shoulder during and two minutes after injection. Most patients have a sensation of warmth and thirst. Allergic patients may complain of slight precordial tightness, nausea, and rarely asthmatoid reactions. Symptoms appear more from fright than from iodine.

Following injection the patient is placed in the 15-degree Trendelenburg position, to which he is returned between exposures. The first exposure, three minutes after injection of the dye, is usually made in the Trendelenburg position with an inter-renal focus. It is followed by a second with umbilical focus and deep inspiration immediately after leveling, to free the kidneys from the rib margins and liver. These films are inspected and the technic modified as indicated, following which an upright exposure is made and bladder studies are done if required. A large compression binder is applied for two minutes for supplemental views in patients with large amounts of gas.

Interpretation can best be done by the urologist in charge. A roentgenologist can see an obvious stone and its backed-up ureter; however, much may be missed by failing to obtain repeated standing views and by not following up clues and correlating x-ray with cystoscopic and clinical data.

The intravenous technic is relatively innocuous. The author resorts to retrograde pyelography in no more than 2 per cent of cases.

CHARLES R. PERRYMAN, M.D.

Injuries of the Kidney. James C. Sargent. J. Urol. **53:** 381–386, February 1945.

In a refreshingly succinct paper, graced by excellent English, the author urges consideration of renal trauma in every case of serious body injury. With the diagnosis in mind, the examiner will then be able to contribute materially to a reduced mortality from ruptured kidney.

Gross hematuria is the sign demanding prompt urologic investigation. The author feels strongly that retrograde pyelograms are far superior to intravenous urograms in indicating the anatomic damage and cites some cases to substantiate this.

Treatment for small tears of the kidney, in which the architecture is fairly well preserved, is masterful inactivity, since recuperative power is very high in such instances. Extensive rupture, in which the pyelogram reveals very little if any semblance to a normal pelvis, demands immediate nephrectomy.

EDWIN L. LAME, M.D.

Renal Tuberculoma and Tuberculous Perinephric Abscess. John A. Benjamin and Hobart L. Boyd. J. Urol. **53:** 265–268, February 1945.

The authors report a case of tuberculoma of the left kidney associated with a tuberculous perinephric abscess in a 29-year-old Italian housewife. Six weeks before admission (September 1939) she suffered from

nausea, vomiting, frequency, and dysuria with associated left costovertebral pain and fever. She had lost twenty-four pounds within the last two months and had been in contact with a sister who had active pulmonary tuberculosis.

Physical examination was essentially negative except for left costovertebral angle tenderness. Acid-fast stain of the urinary sediment showed *Mycobacterium tuberculosis*. Fluoroscopy revealed restricted movement of the left diaphragm, and in a film of the abdomen the left psoas shadow and medial outline of the left kidney were indistinct. For these reasons a left perinephric abscess was suspected. Cystoscopy was negative and intravenous and retrograde pyelography showed deformity of the left kidney pelvis compatible with a diagnosis of tumor or cyst.

Sixteen days after admission, exploration was undertaken, and a left perinephric abscess was drained. Acid-fast organisms were found in the smear. In January 1940, a left nephrectomy was done and a large necrotic area enclosed by a thin superficial membrane was found at the upper pole of the left kidney. Histologically this area showed characteristic tuberculous lesions.

The patient was discharged in April 1940 and was readmitted in April 1942 with a salpingitis which proved not to be tuberculous. Later her health declined gradually and she died of tuberculous peritonitis in December 1943. N. P. SALNER, M.D.

Ureteral Syndromes in the Male: Analysis of 100 Cases. Isidor E. LeDuc. J. Urol. **53:** 295–318, February 1945.

The ureteral syndrome consists of a group of related complaints: pain of renal or ureteral distribution or both, with urgency of urination due directly to the development of such pain as the bladder fills. One hundred cases were analyzed and the patients were grouped in five categories, depending upon the predominating complaints, namely, renal pain, enuresis, "appendicitis," testicular pain, and pyuria. Renal pain is believed to be due to mild stasis, and ureteral pain to depend upon the location of structural or physiological departures from the normal.

Intravenous urography is not considered suitable for the study of the condition, retrograde pyelography being preferable. Certain of the cases show a definite narrowing of the ureter with irregular caliber and with dilatation and stasis above these points. In others, the evidence points to a dysfunction of the autonomic nervous system. The diameter of each ureter is measured in millimeters, and dilatation is classified as borderline or mild if the figure is from 5 to 8 mm., moderate if from 8 to 10 mm., and severe if 1 cm. or over. Elongation of the ureter is common, with distortion of the normal course. A rather characteristic finding is mild to moderate blunting of the calices. Most of the cases cannot be classified simply as stricture of the ureter.

Almost invariably there is costovertebral tenderness on one or both sides or tenderness over one or both ureters. At cystoscopy one can reproduce the pain by filling the renal pelvis and by passing a bulb-catheter. The evidence indicates that infection in these patients is apt to be secondary.

The most effective therapy has been a combination of cystoscopic treatments aimed at dilating the ureter or enlarging the ureterovesical orifice, plus the use of antispasmodics of the belladonna-hyoscyamus group, and the eradication of local or focal infection.

DAVID KIRSH, M.D.

Pathologic Lesions Associated with Ectopic Termination of Supernumerary Ureters: Report of Three Cases. Samuel K. Bacon. J. Urol. **53:** 402–407, February 1945.

Ectopic termination of a supernumerary ureter is a rare anomaly, predisposing to lesions of the upper urinary tract. Up to 1942, approximately 300 cases had been recorded. The ureteral wall is thickened, and the conduit is tortuous and dilated. The corresponding renal segment is hypoplastic or hydronephrotic. Pyonephrosis and pyoureter usually coexist. In women, in whom the condition is more common, the aberrant ureter generally terminates in the vaginal vestibule, vagina, or urethra, and the diagnosis is suggested by a history of incontinence since birth, with normal voiding. In males the stoma is usually in the posterior urethra, and incontinence does not occur, being prevented by the external sphincter.

Catheterization and pyelo-ureterography of the ectopic conduit are the most conclusive diagnostic procedures. The subsequent cystoscopic finding of a single meatus on the same side of the bladder should lead to immediate investigation of the urethra. In the author's experience, each orifice was visualized and with one exception retrograde pyelography demonstrated the associated pathologic lesion. In one of his cases, resection of the cranial segment of the kidney and two-thirds of its ureter could be done. In the two remaining cases, nephrectomy was performed because a single arterial supply precluded partial resection. All three patients recovered completely.

FRANCISCO BASSOLS, M.D.

On the Diagnosis of Rupture of the Urinary Bladder. Olov Fr. Holm. Acta radiol. **24:** 198–205, June 15, 1943. (In English.)

The author describes three cases of rupture of the urinary bladder following accidents. The roentgenographic procedures included general abdominal examination, to determine or exclude intra-abdominal fluid or free gas, and intravenous and retrograde cystography. Retrograde cystography is preferred by Holm, but the danger of air embolism must be considered if air is used as a contrast medium. With regard to the differential diagnosis between intraperitoneal and extraperitoneal ruptures, the author states that in the absence of pelvic fracture the rupture is practically always intraperitoneal while, if the pelvis is fractured, the rupture is probably extraperitoneal. Rupture of the bladder is always to be considered a serious injury, accompanied by a high mortality. E. A. SCHMIDT, M.D.

CONTRAST MEDIA

The Mixing and Flowing Capacity of Water-Soluble Contrast Media in Vascular and Cardiac Investigation. Sven R. Kjellberg. Acta radiol. **24:** 433–454, Dec. 31, 1943. (In German.)

The demonstration of the blood vessels is in the final analysis a roentgenologic problem; the prospect of adequate study with water-soluble media was received with the greatest enthusiasm. However it

was soon discovered that such media had a tendency to "settle out," due to the high specific gravity of the solutions used. This property, which can be reduced by dilution, has led to certain inaccuracies of interpretation of past experiments.

The miscibility of a fluid with water or body fluids is actually dependent on a number of factors, of which the specific gravity is most important. The relative viscosities are also of great importance, while surface tension and diffusibility are of slighter significance. In examination of the vascular system the contrast medium is not placed in a quiet fluid, but in a stream of variable velocity. The question of what effect this has was studied by an experimental system of tubes. The experiments showed that layering, especially along the walls, can readily occur. This effect is seen in some roentgenograms of human subjects printed for comparison. These layers do not necessarily follow a straight course, but produce a wavy pattern in the vessel. There is a tendency to form irregular shadows closely simulating a thrombus defect. Furthermore, the progressive dilution of the medium makes the visual demonstration of the vascular tree less and less sharp.

Some associated studies on the heart were also undertaken, covering both the mixing of the contrast medium in the heart and the demonstration of the passage of the medium through the atrioventricular valves. The studies included observations on a two-chamber model heart and *in vivo* experiments on rabbits and dogs, in which thorotrast was used for a contrast medium. It was shown that the first part of the medium to enter the ventricle has a pale, thin consistency and lacks definition, which makes it impossible to use this method accurately to determine the exact site of the anterior end of the column, the exact site of entrance of the medium into the heart, or the distance the medium travels in a fixed time. The exact moment of opening and closing of the valves, therefore, cannot be determined by this means. The rapid heart rates of the experimental animals increased the unsharpness of the valve shadows, but even with exposures of 1/50 second they were unsatisfactory.

LEWIS G. JACOBS, M.D.

ROENTGEN THERAPY

Two-Year Experience with Roentgen Contact Irradiation. Sven Hultberg. Acta radiol. **24:** 328–338, Aug. 31, 1943. (In German.)

With a Philips-Metalix contact unit (50 kv., 2 ma., 0.2 mm. Al effective wall filter, 2 cm. F.S.D., 10,600 r/min.) the depth dose was found to be about 20 per cent at 1 cm. In treating superficial carcinoma a depth dose of 2,000–3,000 r is needed for a cure. An air dose not exceeding 15,000 r was therefore used. This leads to an immediate reaction (*Sofortreaction*) consisting of slight erythema and edema of the skin which lasts for a few hours to half a day. The erythema may be more persistent, especially after higher doses. The growth begins to regress by absorption after five to seven weeks. Sometimes a slight pigmentation persists for a couple of months. Of 208 patients with primary carcinoma (175 of the skin, 33 of the mucosa), 207 showed primary healing and one was lost from observation. There were 5 recurrences in the first year, all of which responded to further therapy. Satisfactory results were also obtained in a large variety of other conditions, including mycosis fungoides, malignant melanoma, warts, keloids, cavernous hemangiomas, condylomata acuminata, cutaneous tuberculosis, chronic tonsillitis, and tonsillar hypertrophy. LEWIS G. JACOBS, M.D.

Results of Treatment of Cancer of the Breast at Centrallasarettet in Borås, Sweden. Bengt A. Nohrman. Acta radiol. **24:** 478–483, Dec. 31, 1943. (In English.)

This study is based on cases of mammary cancer treated from September 1931 to March 1941. The patients surviving were last examined in February and March 1943. The 205 cases are divided into three groups on the basis of treatment: (1) radical operation plus complete x-ray treatment; (2) nonradical operation; (3) inoperable.

Preoperative treatment consisted of three or four applications of 300 r (205 kv., filter 0.5 mm. Cu and 1.0 mm. Al, 40 cm. focal distance) to each of two fields in six to eight days. Through field I the breast was irradiated from an anterior oblique projection; field II included the breast and axilla and irradiation was directed laterally. When this treatment was given preoperatively only, similar dosage was applied to the axilla posteriorly. Operation followed in three to six weeks, depending on the skin reaction. Postoperative treatment was started as soon as the patient's condition permitted, usually in one to two weeks. Two series were usually given, with an interval of two months, each consisting of eight daily treatments. Two fields were covered: the anterior, including the operative area, supraclavicular region, and axilla; the posterior, including the supraclavicular region and axilla only. The anterior field was given 200 r × 5 (180 kv., filter 4 mm. Al, 50 cm. focal distance); the posterior 300 r × 3 (205 kv., filter 0.5 mm. Cu and 1.0 mm. Al, 40 cm. focal distance).

Group I consists of 154 cases, including 23 in which operation was done in other institutions. Of this group 48 ± 5.5 per cent were alive without carcinoma after five years; 1 ± 1.2 per cent were alive with carcinoma. The remainder were dead. No significant difference was shown between those receiving preoperative radiation, postoperative radiation, or both. Of those with axillary node involvement at operation, 26 ± 6.6 per cent survived five years, while of those without such involvement 74 ± 6.6 per cent survived, a highly significant difference. The end-result was not materially different in medullary and scirrhous forms.

Group II included 8 patients, of whom 5 survived five years and 2 for nine years or more.

Group III, 46 patients, received roentgen treatment only: 11 ± 5.2 per cent survived five years, but half of these died within the next two years. Although the corresponding figure for operated cases (with axillary extension) is 26 ± 6.6 per cent and not definitely significant, there is considerable probability that the operation adds to the salvage rate.

LEWIS G. JACOBS, M.D.

Roentgen Treatment of Carcinoma of the Larynx and Hypopharynx and Its Results. S. Mustakallio. Acta radiol. **25:** 13–32, Feb. 29, 1944. (In German.)

A total of 201 cases of carcinoma of the larynx and 37 cases of carcinoma of the hypopharynx were observed at the Central Institute for Radiation Therapy in Helsinki (Finland) during the years 1936 to 1943. With a single exception, these were treated by x-rays (180 kv., 4 ma., tin filter, 40 cm. distance, field size 6 × 8 or 8 × 10 cm.), daily doses of 250 to 300 r/skin being given to two opposing fields up to a total of 6,000 to 7,000 r/skin within one month.

Five-year cures were obtained in 21 (32 per cent) of 66 patients suffering from carcinoma of the larynx, while only 1 patient out of 12 with carcinoma of the hypopharynx was free of symptoms after five years. Metastases recognized prior to the institution of irradiation did not exercise any considerable influence on the results of therapy. In cases in which tracheotomy had been performed prior to irradiation, the results were about the same as those obtained in Stage III carcinomas. F. ELLINGER, M.D.

Method of Roentgen Treatment of Mediastinal and Pulmonary Tumors. Erik Lundström. Acta radiol. **24:** 462–468, Dec. 31, 1943. (In German.)

Since the position of the thoracic organs is somewhat variable, the author plans the treatment of intrathoracic neoplasms by first taking a plaster mold of the thorax at the level of the tumor and transferring it to a paper. The position of the growth and of the organs is then plotted, with the aid of roentgenograms in various positions and orthodiagrams, and the beams are directed onto the body on the basis of this plan, using a mechanical caliper for centering. [A hard way to do it!—L.G.J.]

In the treatment of bronchial carcinoma pneumothorax on the diseased side is recommended, since, with collapse of the lung, the mediastinal nodes and growth are brought closer together and therefore receive a more equal dose. LEWIS G. JACOBS, M.D.

Roentgen Diagnosis and Radiation Therapy of Sarcoma of the Stomach, with Special Consideration of Lymphosarcoma and Reticulum-Cell Sarcoma. Gösta Forssman. Acta radiol. **24:** 343–373, Oct. 31, 1943. (In German.)

After reviewing the pathology and clinical aspects of sarcoma of the stomach, the author gives the case histories of 9 patients treated at the Radiumhemmet in Stockholm. The series included 4 reticulum-cell sarcomas, 2 lymphosarcomas, and 1 case each of plasma-cell sarcoma, fibrosarcoma, and myosarcoma. The differential diagnosis between these and other tumors of the stomach is discussed.

Preoperative roentgen treatment is considered desirable but in some instances is impossible due to diagnostic difficulties. Operable cases were treated by gastric resection and postoperative irradiation (0.5 mm. copper or tin filtration; 50 to 60 cm. distance). The daily doses varied between 250 and 400 r measured on the skin and the total doses amounted to 2,500 to 3,000 r (skin) delivered within four to six weeks to each of 2 anterior and posterior fields. Supplementary series were given two or three months later in some cases. Of 7 patients with gastric sarcomas which were considered radiosensitive, 3 died within the first two months, while 4 had remained symptom-free eight, seven and one-half, two, and two and one-half years, respectively.

Of interest are some measurements, made by the author in collaboration with Dr. Robert Thoraeus, of the x-ray dose in the cavity of the stomach of patients during roentgen diagnosis. Under the experimental conditions (86 kv., 200–250 ma., field 24 × 30 cm., 1.0 mm. Al filter, 70 cm. focus-skin distance) it was found that only 1.6 per cent of the skin dose (skin of the back) reaches the gastric cavity. F. ELLINGER, M.D.

Recurrences After Radiation Therapy of Carcinoma of the Uterine Cervix. Sven Hultberg. Acta radiol. **25:** 59–80, Feb. 29, 1944. (In German.)

A total of 458 cases of carcinoma of the cervix were observed in the Radiological Clinic of the University of Lund (Sweden) during the years 1927–37. Of these, 451 received radiotherapy. Up to 1932, treatment was exclusively by radium according to the Radiumhemmet (Stockholm) technic. From 1933 on, combined therapy with radium and roentgen rays was employed. One hundred and forty-four patients, or 31.4 per cent, were symptom-free after five years.

The author's study of recurrence was based on 535 patients treated during the years 1927–39. Of these, 281 were symptom-free for various periods following treatment. In 90 (32 per cent) of these primarily symptom-free cases, there was eventual recurrence. Twenty-five per cent of the recurrences involved the cervix, the portio, or the fornices; 17 per cent the parametrium and the pelvic wall. Local recurrences associated with metastases elsewhere were seen in 33 per cent of the series, and recurrences in other areas than those mentioned occurred in 19 per cent. In 6 per cent of the cases the recurrences could not be localized. Sixty per cent of the recurrences were observed within two years of treatment, and 84 per cent within three years. Only 7 per cent are classified as late recurrences, *i.e.*, after five years.

Of 16 patients on whom hysterectomy was performed following irradiation, 12 were symptom-free three to eight years after operation. On the basis of this admittedly small number of observations, the author discusses the possibility of reducing the risk of recurrence by radiation therapy followed by surgical intervention on a larger scale. F. ELLINGER, M.D.

Radiation Therapy in Chronic Leukemia. T. G. Clement. Illinois M. J. **87:** 84–88, February 1945.

The response of chronic myeloid and lymphatic leukemia to short-wave radiation is explained on a cytologic basis. In the order of their sensitivity to the action of such radiation, lymphoid cells come first, followed by polymorphonuclear leukocytes or bone marrow cells. All other cells and tissues are more resistant.

The first consideration in treatment of the chronic leukemias is the physical condition of the patient. Thus, the discomfort due to enlargement of the spleen should receive attention before the laboratory findings, of which the patient is unaware. Slow and careful irradiation will "slowly, it is true, but surely" relieve the symptoms. Avoidance of radiation sickness by the use of small initial doses is of paramount importance. If this precaution is not observed, the patient, instead of being moderately comfortable, becomes definitely ill, with a pernicious mental association of treatment with radiation sickness.

The first dose, usually given over the spleen, should not exceed 100 r. The author finds 75 r sufficient in most cases (135 kv.p., 6 mm. Al filtration). A second treatment is given after a week or ten days, and subsequent treatments are spaced in accordance with the symptomatic response or modification of the blood picture. The second treatment may be given to the marrow of one of the long bones or, if there is sternal pain, over the sternum, or the spleen may be treated again. After three or four treatments an accurate estimation of the patient's susceptibility to therapy may be made and a proper plan of action formulated.

In chronic lymphatic leukemia, enlarged lymph nodes usually call for attention first, either for cosmetic reasons or because they are producing symptoms, the main consideration here, also, being to the patient's comfort and well-being. Enlarged nodes distant from the treated areas often regress spontaneously. As in myeloid leukemia, the dose is kept down to 75 or 100 r, and a single area is treated initially.

In the ensuing discussion, the author stated that over a 17-year period he had 12 patients with leukemia who lived 12 years and 5 who lived nearly 15 years.

LESTER M. J. FREEDMAN, M.D.

RADIATION EFFECTS

Fluoroscopic Hazards, Including Use of Unprotected Radiographic Screens. Charles F. Behrens. U. S. Nav. M. Bull. **44:** 333–340, February 1945.

The author states very clearly the dangers of fluoroscopy. He has shown by careful measurements the total amount of radiation which will be received by the patient under different fluoroscopic conditions, as well as the amount which can be expected to be received by the operator. In addition to measurements on the ordinary fluoroscopic machine, he checked the amount of radiation which would pass through an intensifying screen in a cassette, since these have been used for emergency fluoroscopic work. Under such conditions, the operator would be without the protection of the lead glass normally present on a fluoroscopic screen. It is believed that such a set-up should be used only in extreme emergencies and then for only very short exposures and that under no conditions should it be employed as a routine measure.

The author recommends many protective measures, most important of which are: (1) good dark adaptation of the eyes; (2) use of moderate current: 75 kv.p. and not over 4 ma.; (3) intermittent exposure; (4) keeping the size of the field small; (5) keeping the hands out of the direct x-ray beam; (6) use of aluminum filtration; (7) use of lead-impregnated apron and gloves; (8) use of dental film as a test for amount of exposure; (9) frequent blood counts of the operators; (10) good ventilation of the fluoroscopic room. He warns against the use of any fluoroscopic apparatus by untrained personnel.

BERNARD S. KALAYJIAN, M.D.

Subsequent Degenerations after Fractional Protracted Roentgen Irradiation. Olof Sandström. Acta radiol. **24:** 289–294, Aug. 31, 1943. (In English.)

In evaluating new forms of radiotherapy, it is necessary to take into account the late changes which may appear. The time factor must be considered in relating damage to dose. Zuppinger's numerical estimate (Strahlentherapie **70:** 361, 1941 and **71:** 183, 1942) is used here for this purpose. For example, if a 20-day distribution of dose is taken as unity, a 40-day distribution will permit a dose 1.3 times higher. Zuppinger's general conclusions are cited, as follows:

1. Five years is insufficient for evaluation of damage, both degeneration and improvement occurring after that time.
2. The degree of primary damage is not well correlated with the degree of late damage.
3. Individual sensitivity variation is ± 15 per cent.
4. The skin of women is 20 to 25 per cent more sensitive than that of men.
5. Tissues will tolerate operation after fractional protracted irradiation.
6. A dose of 3,300 r in 20 days leads to no definite late degeneration; 3,900 r in 20 days is the dose for epilation and moderate telangiectasis; 4,600 r or over in 20 days leads to skin atrophy and induration.
7. Atrophy of the lymphoid tissue at the base of the tongue appears readily but persists only with doses above 4,500 r. Telangiectasis of the vocal cords appears after 3,200 r, but mucosal edema and induration only with doses in excess of 4,500 r.

The author reports five cases treated with the following factors: 164 kv., 4 ma., Thoraeus filter, 60 to 70 cm. F.S.D., h.v.l. 1.7 mm. copper, intensity 5 r/min. on the skin and 3 r/min. in the tumor.

In Case 1, a squamous carcinoma of the hypopharynx, the skin dose was 4,500 r and the tumor dose 4,600 r. Two years after treatment telangiectasis of the vocal cords developed, and after five years the epiglottic mucosa was atrophic and pale. The "reduced tumor dose," *i.e.*, reduced to fractionating over 20 days, was 3,500 r. In Case 2, a cancer of the epipharynx with cervical metastases, a tumor dose of 6,200 r was given, a skin dose of 3,600 r, and a skin dose to the cervical lymph nodes of 5,200 r. The "reduced doses" were 4,100 r, 2,400 r, and 3,900 r, respectively. After seven years the only damage was a slight telangiectasia of the neck fields. Case 3, a reticulum-cell sarcoma of the epipharynx with cervical metastases, received a tumor dose of 4,770 r ("reduced," 3,200 r) and a skin dose of 4,400 r ("reduced," 2,900 r). There was no late damage after five years. Case 4, cancer of the penis, received a dose of 5,300 r ("reduced," 4,000 r). Three years later there was gross atrophy with parakeratosis and epithelial hyperplasia of "partly precancerous shape." In Case 5, actinomycosis, the skin dose was 4,800 r ("reduced," 4,000 r), with no late damage after six years.

The author believes that Zuppinger's estimate of the effect of the time factor on the dose in protracted irradiation is accurate. LEWIS G. JACOBS, M.D.

Inactivation of Malarial Parasites by X-rays. B. E. Bennison and G. Robert Coatney. Public Health Rep. **60:** 127–132, Feb. 2, 1945.

Sexual and asexual forms of *Plasmodium gallinaceum*, an avian malarial parasite which produces uniformly fatal infections in young chickens, were irradiated *in vitro* by x-rays (200 kv., 20 ma., no filter, 20 cm.

distance, 1,450 r per minute). Trophozoites were inactivated by 20,000 r but not by 10,000 r; sporozoites were inactivated by 8,000 r but not by 6,000 r. Trophozoite suspensions exposed to 2,000 to 8,000 r produced infections characterized by lengthened prepatent periods and lengthened survival times.

Therapeutic irradiation of infected chickens (200 kv., 20 ma., 0.25 mm. Cu + 1.06 mm. Al, 40 cm., 68 r per minute) had no significant effect on the outcome of the infection.

Human blood infected with *Plasmodium malariae* and exposed to 5,000 r failed to produce an infection in a susceptible patient.

Experimental Roentgen Injury. I. Effects on the Tissues and Blood of C3H Mice Produced with Single Small Whole-Body Exposures. II. Changes Produced with Intermediate-Range Doses and a Comparison of the Relative Susceptibility of Different Kinds of Animals. III. Tissue and Cellular Changes Brought About with Single Massive Doses of Radiation. IV. Effects of Repeated Small Doses of X-rays on Blood Picture, Tissue Morphology, and Life Span in Mice. Paul S. Henshaw. J. Nat. Cancer Inst. **4:** 477–484, 485–501, 503–512, 513–522, April 1944.

A series of experiments is recorded in which the author sought to correlate certain blood and tissue changes due to roentgen irradiation on a time basis. The first studies were of alterations produced in C3H mice by whole body irradiation with a single dose of 50 r (200 kv., 20 ma., 0.5 mm. Cu and 1.06 mm. Al, 105.3 cm. distance, 8 r per minute). Faint but nevertheless detectable blood and tissue changes were observed. A slight leukocytosis developed in two to four hours, followed within eight to twelve hours by a mild but persistent leukopenia, due largely to a reduction in lymphocytes. A small amount of nuclear debris was seen in the lymph nodes at two to four hours, but this disappeared and a mild hyperplasia occurred in eight to twelve hours. The seminiferous tubules of the testis showed a significant reduction in spermatogonia and primary spermatocytes at one week and of secondary spermatocytes at two weeks. Regeneration took place and the tubules appeared normal in four to six weeks.

Mice and guinea-pigs were then submitted to larger doses—those commonly used in therapy—up to 400 r. For the mice the factors were as in the earlier experiments except that the distance was reduced to 50 cm., making the intensity 38 r per minute. For the guinea-pigs two x-ray beams were employed and the intensity was 71 r per minute. Generally changes of the same kind were observed in the peripheral blood, lymph nodes, spleen, bone marrow, and testes in both the mice (two strains) and guinea-pigs, consisting in a loss of functional cell elements followed by a slow return to normal if the damage was not too severe. All the animals showed a fall in the lymphocyte level. The neutrophil level was also reduced, but with certain differences in the three groups. Lymphoid tissues showed loss of small lymphocytes in the first twenty-four hours, with return to normal in two to six weeks or longer. There was a similar loss of parenchymatous cells in the bone marrow, resulting in the formation of extensive blood sinuses, with recovery extending over six weeks or more. In the testes the first elements to disappear were the primary spermatocytes. With the higher doses these were completely lost and there was a distinct thinning of spermatogonia. As time passed, the secondary spermatocytes disappeared, owing in part or entirely to further maturation. Regeneration took place through reappearance of the cell types in the order of maturation—spermatogonia alone first, then spermatogonia and primary spermatocytes, and finally all three types, with the eventual appearance of mature sperm.

Comparing the observation on the different tissues, the author concludes that in each instance regeneration started from primitive cell forms that had survived irradiation fatal to other cells. As in the earlier experiment, leukocyte reserves appeared to prevent the peripheral blood picture from reflecting exactly the condition of the hematopoietic tissue in those animals receiving low dosage. Incidentally, the differences in response of the different groups of animals were sufficient to indicate the necessity of using homogeneous groups for critical studies.

In a third set of experiments, on mice, guinea-pigs, and rabbits, much larger amounts of radiation were used, 25,000 and 50,000 r being given in a single dose at an intensity of 250 r per minute. With such massive doses, "the devastation produced in the animal's tissues in the brief period of 3 hours was almost unbelievable. There was no tissue in the body which did not suffer; even the most resistant of tissues such as brain and muscle showed marked damage." Guinea-pigs exposed to 50,000 r died approximately three hours after irradiation was begun; rabbits died in three to six hours after irradiation; mice in twenty-four to forty-eight hours. Death appeared to result from a distinctive type of shock quite apart from that usually seen following trauma, burns, and other injuries. It was characterized by generalized toxemia, hyperthermia, hyperesthesia with intermittent seizures, and cyanosis. Tissue sections showed extensive nuclear and cytoplasmic degeneration followed by parenchymatous cell loss.

Finally mice were treated with repeated small doses of radiation, 5, 10, 15, 20, and 25 r being given daily until the death of the animal (8 r per minute). Various progressive and terminal changes were observed. There was a fall in leukocyte level due mainly to lymphocyte loss and varying progressively as treatments proceeded and directly with the size of the daily dose. Shortening of the life span was noted, the degree of which also varied with the daily dose. Leukemia developed in some of the mice receiving 15 and 20 r daily.

Experimental Roentgen Injury. V. Effects on Hematopoietic Reserves and Regenerative Capacity. Paul S. Henshaw, Jean W. Thompson, and Henry L. Meyer. J. Nat. Cancer Inst. **5:** 233–247, February 1945.

The experiments described here (continuing the studies described in the preceding abstract) were designed to deal with subliminal effects of radiation and the reserve capacities of certain tissues. Two-to-three-months-old C3H mice were used exclusively. Samples of 40 animals were given single acute doses applied to the whole body. The dosage pattern was as follows: 12 1/2 r administered twice weekly, 25 r once weekly, 50 r at fortnightly intervals. In addition to the preceding dosages, 100, 200, and 400 r per treatment were employed.

The lymphocyte level was used as a guide. Treatment was continued until the lymphocytes dropped significantly below 4,000 cells per cubic millimeter, at which time they were discontinued until the lymphocyte level rose above 4,000 for two consecutive weekly counts. The following trends were revealed: (1) The number of treatments required to lower the lymphocyte level to 4,000 or below became less and the period of recovery became longer as the experiment progressed. (2) Eventually all of the animals tended to pass into a persisting lymphopenia. (3) In each case, irrespective of the size of the treatment dose, this condition occurred when the accumulated dose reached 300 to 500 r.

ELLWOOD W. GODFREY, M.D.

Effect of Ionizing Radiations on the Broad Bean Root. V. The Lethal Action of X Radiation. L. H. Gray, John Read, and M. Poynter. **VI. Summation of the Effects of Radiation of Different Ion Density.** L. H. Gray and John Read. Brit. J. Radiol. **16:** 125–128, April 1943; **17:** 271–273, September 1944.

In these two papers, the authors continue the account of the experiments outlined in earlier contributions (Abst. in Radiology **41:** 526, 1943). In the first they discuss the lethal action of x-rays on the root of the broad bean, *Vicia faba*, and in the second the effect of combinations of neutron and gamma radiation and of alpha and x radiation. The latter pair were the more thoroughly studied. The combination of neutron and gamma radiation was slightly more effective than either radiation alone, while the alpha and x radiation in combination were slightly less effective than either alone.

These findings confirm the theory that the lethal effect of all four radiations depends on the same primary injury and the efficiency depends upon the differences in the amount of ionization and the spatial distribution of the ions.

SYDNEY J. HAWLEY, M.D.

Experiments with Mammalian Sarcoma Extracts in Regard to Cell-Free Transmission and Induced Tumor Immunity: A Summary. Carl Krebs. Acta radiol. **24:** 190–197, June 15, 1943. (In English.)

This article is a summary of the work done by Krebs, Harbo, and Thordarson on mouse leukosis and published in full as a separate supplement to *Acta Radiologica* (Supplementum XLIV).

The object of the investigations was to find out whether experimental animals (mice) which had been inoculated with cell-free extracts, adsorbates, ascites fluid, etc., without developing tumor growth or leukosis, were more or less susceptible to subsequent abdominal inoculations with tumor-cell-containing ascites fluid than mice which had not been so pre-treated.

The results were different in two groups of animals. In the one group in which the animals had been inoculated with adsorbates of aluminum hydroxide, carbon or diatomaceous earth, there was practically no difference regarding the percentage of tumor "takes" between pre-treated animals and non-treated controls. In the second group, where the mice had been previously inoculated with cell-free extracts or their residual solutions, the proportion of cases in which the subsequent injection of ascites fluid produced tumor growth was so very much smaller than in the controls that it appeared probable that the pre-treatment with cell-free material had induced an increased tumor resistance.

Among the experiments carried out was one in which the tumor-cell-containing material was irradiated prior to inoculation. Growth was obtained in 6 cases after irradiation with at least 4,260 and 6,860 r, but tissue irradiated with larger doses gave negative results. Since much greater amounts of radiation are required for the inactivation of a virus than of tumor tissue, the results obtained are not considered sufficient basis for assuming a virus as the cause of the tumor in question. Other experiments pointed to a similar conclusion.

E. A. SCHMIDT, M.D.

Studies on Synergism of Leukemogenic Agents in Mice. Henry S. Kaplan and Arthur Kirschbaum. Proc. Soc. Exper. Biol. & Med. **55:** 262–264, April 1944.

Furth and Boon (Science **98:** 138, 1943) recently reported a synergistic effect of methylcholanthrene and irradiation in the production of leukemia in Rf/Ak hybrids. In the present study, strain Dba and strain F mice were used to determine whether this observation held true in other susceptible mice. The strain F mice received a total of 720 r whole body irradiation in nine daily doses of 80 r (140 kv., 30 cm. skin-target distance, 2 mm. Al filter), while the more hardy Dba animals received a total dose of 880 r. In one group of mice, irradiation alone was used, in a second 0.5 per cent methylcholanthrene was applied percutaneously twice weekly, and a third received both types of treatment, the first application of carcinogen being given on the first day of irradiation. It was found that irradiation in conjunction with methylcholanthrene failed to increase the incidence or accelerate the onset of carcinogen-induced leukemia in the strains studied.

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